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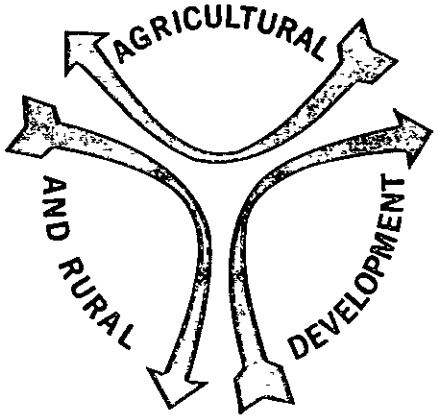
UTILIZATION OF FOOD AID IN ECONOMIC DEVELOPMENT



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UTILIZATION OF FOOD AID IN ECONOMIC DEVELOPMENT

by

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FOREWORD

The use of agricultural commodities as one means of foreign assistance has now become part of the planned production of agricultural output in the United States. Each year, several billion dollars of food commodities are produced with the implicit intent that these commodities will be used as aid to developing countries. With productivity and capacity advances keeping pace with domestic and commercial export demand, the prospect is excellent that this kind of assistance will remain feasible for many years into the future.

Thus, it becomes highly practicable to develop a thorough understanding of all economic relationships relating to the use of food as aid to developing economies. Such aspects as alternative distribution methods and their effect on utilization levels need thorough evaluation if the effectiveness of food aid is to be maximized. Also, the great need in many underdeveloped countries is to expand total employment and here the opportunities for using food as wages-in-kind become important. But there are limits on the proportion that food aid can make up of total investment in work projects. This study develops a specific set of relationships which can be used in any particular country to determine the optimal amounts of food aid for a given type project.

Furthermore, there has long been argument in economic circles over the adverse effect of P.L. 480 shipments on recipient economies. A sizeable analysis is made of this issue in this study. The result is substantial new evidence that the adverse impact may have been greatly overestimated in past studies. Given the kinds of controls on distribution methods outlined in this study, it is quite possible that food distribution is the future can provide positive welfare gain to specific groups while having little or no negative effects on other groups in the economy.

It is the need for a thorough understanding of these kinds of tradeoffs which stimulates this particular study. The potential for using food commodities as a major tool for international peace has long been obvious. The missing component has been an indepth assessment of the constraints within which these programs must function to achieve the desired objective of a more rapid rate of development. We believe that this study adds a substantial amount of knowledge to the total understanding in this area. We further believe it will be of substantial value to policy makers, administrators and others interested in maximizing the impact from use of American farm commodities for overseas programs.

Earl O. Heady
Executive Director

August 30, 1971

Leo V. Mayer
Project Director

TABLE OF CONTENTS

Part I - Summary

Summary and policy guidelines for programming food aid 1

Part II - Theoretical and Applied Analysis of Food Aid

Introduction 35

Interrelationships of income levels and commodity aid in financing development 70

Influence of demand and differentiation on the impact of P.L. 480 shipments 103

Distribution methods and the impact of food aid 137

Part III - Technical Appendices

Appendix A - Repayment terms on food aid contracts and the net value of aid 177

Appendix B - A review of empirical consumption studies 183

Appendix C - Income level as a factor in derived demand for food aid 192

Appendix D - A simplified equilibrium model to evaluate distribution methods 209

Part IV - References 220

SUMMARY AND POLICY GUIDELINES FOR PROGRAMMING FOOD AID

There are four basic aspects of programming commodity aid. They include

1. the terms under which a donor provides commodities to a recipient;
2. the consumer groups to which commodities are distributed in the recipient country,
3. the method and terms by which commodities are distributed to consumers in a recipient country, and
4. the allocation of resource or revenue proceeds from 'sale' of these commodities by the recipient country.

The terms under which donors provide food aid are closely linked to their own objectives which may include surplus disposal, emergency relief, expansion of commercial exports, or economic development of recipient countries. The relative weights on each of these objectives influence the contractual terms, varying from grants and loans with lenient conditions for payments to short-term, hard currency sales and strict conditions for payments. Achievement of internal objectives of recipient countries is affected by which consumer group ultimately receive the food aid. Consumers in low income groups have limited income to allocate among alternative consumer goods so that grants or highly subsidized sales are the only way to have a significant impact on their welfare. On the other side, higher income consumers have income to allocate along alternative commodities so that increasing the aggregate food supply and thereby depressing food prices can raise total welfare of this income group.

The method of distribution determines which group will or will not participate directly in food aid programs. Group differentiation, by capitalizing on certain characteristics of consumer behavior, provides one key to achieve specified objectives of food aid. The method of distribution determines both the recipient group and amount of welfare or income subsidy incorporated in food aid. The allocation of labor provided in exchange for wages-in-kind or revenue from open-market sales determines the major long-run impact of food aid. Projects on which labor can be used range from production of consumer goods to construction of housing or provision of medical aid and other welfare projects. The revenue can be used for similar projects or can be used to meet other types of government expenditure. The manner in which recipient governments allocate resources, not only food aid and other foreign assistance but domestic resources as well, and commit them to development activities determines the impact of food aid both in the short and long run. "Indeed, so important is the role of government as an agency in mobilizing, organizing and directing the use of development resources in less-developed countries that no program of financial and technical assistance...is likely to succeed without also a strong commitment to the objective of agricultural progress by less-developed countries themselves or without a government strong enough and stable enough to do what needs to be done" (44, p. 9). Hendrix points out that governments of developing countries have a crucial and influencial role to play in the developmental process.

The government of a recipient country has numerous alternatives for utilizing food aid; not all of these alternatives are economically consistent with development strategy. The manner in which a recipient government molds the four basic aspects of commodity aid into a compatible plan and coordinates it with other development efforts of the country will determine the prevailing impact of P.L. 480 or similar commodity aid programs.

Summary of Principles Associated with Food Aid Utilization

The following sections summarize the many aspects of food aid which are discussed later in the report. The objective is to link together these different aspects and relate their meaning to economic development in recipient countries. Finally a set of guide lines are set out at the end of the section on the use of food aid in the overall process of development.

Repayment terms and net value of aid

Unless food aid is provided to recipient countries as a grant or donation, there is some positive cost associated with its procurement. Extended credit terms reduce the immediate obligation, but increase the future obligation by the amount of an interest factor. Continuous contracting of food aid not only obligates a country to a future liability, but can actually move the country into a position of greater annual debt obligation than the annual amount of aid received. For the case where a constant value of aid is given annually and repayment is over a 20 year period (as presented in Figure 1) at 4 percent interest, payments

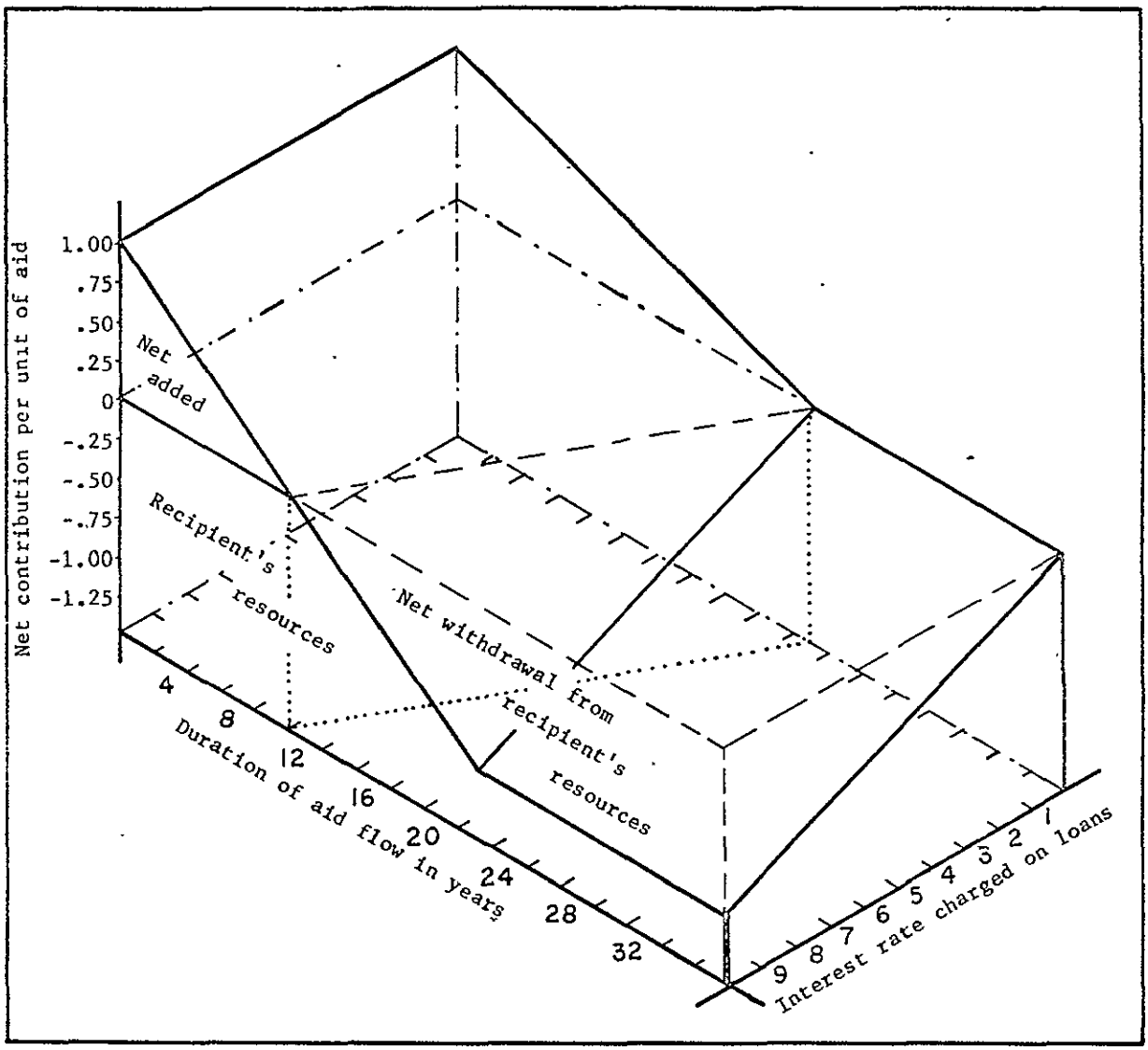

Figure 1. Effect of aid flow duration and interest rates on recipient's net resource position after loan servicing (20 year repayment schedule)

equal the value of aid between 13 and 14 years.[1] From that point on the net value of the aid is negative and payments exceed new aid received. Agreements which provide commodity aid on a grant or donation basis avoid the problem of negative aid. The absence of a repayment commitment allows a perpetual flow of grants or donations to maintain a net aid value equal to gross aid value. Sales or barter agreements also avoid the problem of negative aid since the effective aid value is always zero. However, long-term loan agreements result in a net aid value from gross aid value down, depending on interest rate and period over which repayment is scheduled.

The trend toward concessional sales contracts for long-term credit and the eventual net negative addition to government resources emphasizes the importance of "investing" food aid in recipient countries so that it will result in an increase in productivity and make a positive contribution to development. At minimum, the food aid must increase productivity at a rate greater than the interest on the contract if the food aid is to make a long-run positive financial contribution to the recipient economy. The conditions under which food aid can be used as an "investment" depends on numerous interrelated aspects of consumer behavior, distribution, and production response. The need for meeting these conditions puts a moral and economic responsibility on a donor to provide food aid only on a basis which will not be detrimental to the recipient economy.

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[1] For mathematical formulation and alternative repayment plans of 10, 20, and 30 years, see Appendix-A.

Development and the contribution of food aid

There are several basic objectives or goals for use of food aid if it is to be an effective instrument in promoting development. Among these goals are a relative equilibrium between supply and demand which produces a certain degree of price stability, increased employment through expanded investments, and higher levels of gross national product and per capita income. Food aid can effectively serve to meet all these goals simultaneously. Of primary consideration is the lagging agricultural supply in most developing economies where a large portion of consumer income is spent on food. By "investing" food aid in activities to expand food production, food aid can promote production to satisfy excess demand. Expanding production in labor intensive production processes such as developing agriculture provides an expanded demand for labor, increasing employment and consequently increasing levels of personal income. The "investment" of food aid to promote food production can vary from underwriting research and development activities to providing resources and overhead investment in new institutions such as credit, transportaion, marketing. Thus, food aid offers one tool for attacking the "vicious cycle of poverty." One major asset of food aid as a source of "investment" is the contractual provision for long-term credit which is consistent with the extended payoff periods of development investments.

In most developing countries, the economy is dominated by agriculture because the largest proportion of the population is in that sector. Development within agriculture can make a major contribution toward meeting minimum food requirements for the society. A developing agriculture can

release labor and provide raw materials for use in industrial development. Once food supply surpasses domestic demand, agriculture can supply commodities for export and foreign exchange earnings. Also, because of its relative size, agriculture provides a major proportion of demand for industrial output.

On the opposite side, lagging development in the agricultural sector contributes to higher food prices and lower real income levels for consumers, thus reducing the amount available to spend on other commodities. If food production lags sufficiently, it may become necessary to divert scarce foreign exchange into food imports. Finally, low productivity traps labor within agriculture and reduces the possibility of furthering industrial development.

Economic development basically requires two elements--a sufficient and productive labor force and an accumulating supply of capital. Due to the nature of the savings function, capital accumulation in low income countries contribute little to savings and investment during early stages of development.

Inflation also has an impact on development as well as consumer welfare. In general, inflation tends to shift income from fixed income recipients to those controlling productive resources. The shift may actually contribute to higher aggregate savings and investment, but the investment may be inefficient if made primarily for speculation purposes to avoid future inflation. The use of food aid to finance selected overhead investments may create an atmosphere which is conducive to private investment in high

priority areas.

Food aid provides a unique potential for supporting economic development activities in recipient countries. Because a large share of consumer expenditure in developing countries is for food, and because growth of food supply tends to lag growth of food demand in these countries, the food market can be a major source of inflation. Providing food aid to the developing countries offers a temporary means of restraining price by increasing the supply of commodities. If distributed in return for services or revenue, food aid can finance development investments which will increase domestic production and combat inflation on a permanent basis. Food aid can also be used to expand domestic production and provide import substitutes which result in foreign exchange earnings. The increased availability of foreign exchange can further aid economic development by allowing for importation of critical material and equipment to support domestic investments.

Consumer responsiveness and intersectorial linkages

With P.L. 480 contracts amounting to nearly a billion dollars a year, and estimates of the amount which will be consumed directly or indirectly as foodstuffs ranging as high as 95 percent (113, p. 42), consumer response patterns become a central focal point for evaluating the impact which food aid will have on consumer welfare. More specifically, the response of consumers to increased availability of food holds the key to the impact which food aid shipments will have on the rest of the economy. The two major variables which influence consumption patterns are income and price

levels. Engel's Law indicates that as income increases, the percent of the budget which will be spent on food declines, resulting in an increased proportion being spent on nonfood items. From the breakdown of countries by income level for which P.L. 480 contracts were authorized in 1968, three annual per capita income levels were selected to represent low ($75), medium ($250), and high ($450) income situations. Through a combination of economic principles, elasticity estimates from various empirical studies, and international data relating to average consumption estimates, consumer response patterns were developed which might be anticipated in developing countries. Associated with response patterns are numerous implications for effective food aid utilization and development.

Summarizing the consumer response patterns, low income consumers ($75) have a strong preference for food which results in an average propensity to consume food of approximately 0.69, a marginal propensity to consume of approximately 0.55, and a corresponding income elasticity of demand for food of 0.80. The initial impact of supplying food aid to the low income consumer directly as food or indirectly as wages is an increased income level, resulting in an increase in the demand for food of about 55 percent of the incremental income and demand for nonfood of about 45 percent of the incremental income. When food is distributed directly, roughly half of it will be traded away in the market system to obtain nonfood commodities, or part of the previous food demand will be foregone. Assuming that all of the previous food supply was domestically produced or that previous levels of imports are maintained, the additional 45 percent of commodity aid represents direct competition with domestic

production and has a strong implications as a price depressing force.

At the medium income level ($250) consumer preference for food is not as strong. Average propensity to consume food was estimated at 0.47, marginal propensity to consume at 0.34, and a corresponding elasticity of food demand of 0.73. At the medium income level, incremental income resulting from food aid would generate a marginal demand for food of only 34 percent of the aid while marginal demand for nonfood would be 66 percent. As in the low income case, the 66 percent which is traded directly or substituted for nonfood, creates direct competition for domestic production. The magnitude of food aid for which demand would not be created increases by about 50 percent from the low income case to the medium income case, and thus represents a greater price depressing force than in the low income case.

At the high income level ($450), consumer preference for additional food is relatively weak. On the average 39 percent of the budget is allocated to food but only 26 percent of marginal income is spent on food for a corresponding income elasticity of 0.66. At the high income level each dollar of food aid which represented incremental income would generate demand for 26 cents of food and 74 cents of nonfood. Consequently, for each dollar of food aid, 74 percent would reflect on the market as competition for domestic production.

At each of the three income levels some portion of the food aid replaces demand for domestic food and consequently causes a depressing effect on prices. The lower prices cause lower incomes for producers and will reduce domestic supply of food if producers are responsive to

market prices. Food aid would increase consumer welfare and the demand for nonfood items, but would do so at the expense of the domestic agricultural producers. The higher the income level of consumers, the greater the increase in demand for nonfood items and consequently the greater the negative impact on agricultural production.

A change in the price structure triggers a second consumer response which would affect food demand. The second response is the reaction to a shift in terms of trade. As the price of food falls relative to other commodities, the quantity demanded will increase. As with the income effect, there appears to be a strong correlation between price responsiveness and income level just as there is between response to income changes and income level.

For the low income consumer case, price elasticity of demand for food was estimated at -0.90. If food prices fall by 1 percent, quantity of food demanded will increase by .9 of 1 percent. The increase in demand associated with a price decline could absorb the extra food supply resulting from the food aid, but cannot create an adjustment which will clear the market and also maintain revenue for domestic producers. A price decline of any magnitude implies a fall in total expenditure on food as long as the price elasticity has an absolute value of less than 1.0.

Price elasticity for the medium income consumer was estimated at -0.70, so that a price decline would result in less absorption of the extra food than with the low income case. Prices would have to fall more to

clear the market than in the previous case, and the loss of revenue to the domestic producers would increase if food aid were supplied to consumers in the medium income group. The loss of revenue to agricultural producers implies an increase in revenue for the industrial producers.

Progressing to the high income case, price elasticity of demand for food was estimated at -0.50 so that domestic prices would have to fall further than in either of the previous cases in order to clear the market and agricultural producers would suffer a large income loss. The high income consumers would generate the least demand for additional food if incremental income was supplied through the distribution of food aid, and they would also respond the least to a decline in prices which would result from the expanded supply. Consequently, the higher the income level, the greater the surplus of food that would be created by supplying aid in the form of food, or the greater the price decline necessary to clear the market. In either case, reduced production or a price decline, the agricultural producers suffer a greater negative impact as the income level of the consumers who receive the food aid increases.

Financing development investments with commodity aid

The response of consumers to increased income is closely related to the substitutability of food aid for other forms of capital to finance investments for development. Essentially, food aid can substitute for capital on dollar-for-dollar basis up to the amount of additional demand for food which will be generated by development investments. Beyond this point supplying additional food aid will create a market surplus which will

have a depressing effect on prices, lowering the value of the food aid directly as well as indirectly through the negative impact on producer welfare.

Although the actual magnitude of derived demand for food resulting from an investment can only be calculated as an ex post response, an ex ante estimate can be made based on knowledge of the composition of the investment and the characteristics of the consumers who will become recipients of income generated from the investment. Of the total income created by a given investment, leakages for savings, imports and taxes reduce the amount available as disposable income for consumers. In allocating disposable income, consumer preferences determine the demand which will be generated for alternative commodities.

Theoretically food aid should be a near perfect substitute for capital on a project which was composed entirely of labor inputs and employed previously unemployed personnel without an income. In this case the total cost of the project would be for labor and the employees would have marginal propensities to consume which approach unity so that little or none of the income would be saved. From the previously derived estimates, consumers with very low incomes would allocate all or nearly all of their disposable income for food purchases. Assuming that the food supplied as aid to finance the investment was a relatively close substitute for domestic commodities in the diet, food aid for low income consumers could be substituted for capital on an equal basis for the entire amount of the investment. Furthermore, providing wages in the

form of food would prevent inflationary pressures on food prices.

On a practical basis, development projects will not consist only of labor inputs, and labor will not be supplied totally by employees without any income so that wages will represent only a portion of the total investment and food purchases will only be a portion of total consumer expenditure. The proportion which derived food demand represents of the total investment sets the limit on the amount of food which can substitute directly for capital in financing development. Due to the inverse relationship between income level and marginal propensity to consume food, projects which draw labor from low-income groups can utilize a higher proportion of the investment as food without a negative impact on domestic prices than projects which draw labor from higher income groups, ceteris paribus. If a broader concept of commodity aid than just food is considered, the differences between income groups are not as distinct because the marginal propensity to consume all goods varies less between income groups than the marginal propensity to consume food. Consequently, the lower the per capita real income in a developing country, the larger the development effort which can be financed with food or commodity aid per unit of supporting capital.

Expanding demand to utilize food aid

With the exception of disaster or other emergency situations, an effective demand for food aid commodities will exist in a recipient country only if the food aid displaces commercial imports from donor countries or third country competitors, it displaces domestic production,

or demand expands. Various international organizations have developed a set of principles emphasizing the importance of protecting third country trade when making concessional sales. P.L. 480 requires that concessional sales be made only as an addition to commercial exports. Protection and expansion of domestic agricultural supply is a primary objective of many developing countries. If the interests of all three of these groups are considered, only one alternative for food aid remains, and that is to expand the demand for food in the recipient country.

One source of demand expansion is development investments. Investments in development projects financed with food aid have an element of derived or expanded demand for food which results from increased income generated from the investment. Other alternatives for expanding demand include direct income and price subsidies. In the U.S. demand expansion has been accomplished through income subsidies in the form of direct distribution of commodities and food stamp programs. India has used fair price shops where lower prices are charged for P.L. 480 imports than for similar domestic commodities on the open market. Analysis (in this study) of twelve years of data from India indicates that the fair price shop system has been sufficiently effective in expanding demand so that any negative impact on domestic production has been minimal.

It appears that distribution of P.L. 480 commodities to restricted groups at prices below domestically produced commodities is an effective way to expand demand in developing countries. If commodity aid is sold through retail outlets at reduced prices, the additional sales will serve as a stimulus to develop the marketing system while simultaneously improving

consumer welfare. By combining a food stamp program with a fair price distribution program, the government could develop a mechanism for providing additional welfare benefits to selected groups.

Demand expansion provides the means for using food aid to provide welfare benefits to consumers without having a negative impact on producers by depressing prices and revenue. At the same time, if food aid imports satisfy increased demand, producers in the donor countries and other exporting countries can maintain their commercial exports.

Impact of alternative distribution methods on consumption and production

Variation in consumer response with respect to price and income changes suggest that distribution to selected groups of consumers can produce significantly different effects on the economy. In addition to the demand effect, and the associated impact of price changes on supply, specific distributional methods have a direct effect on the amount of "investment" achieved through programming food aid and the direct impact which the additional investment will have on supply.

Under present P.L. 480 provisions, the U.S. is supplying food commodities under three basic plans--cash or credit sales, donations, and barter agreements. The recipient countries are in turn distributing food under three basic plans--grants, wages-in-kind, and sales. In practice, the method of distribution in a recipient country is usually tied to the alternative plans through which food is made available by the U.S. However, there is no technical or legal reason why the method of supplying and distributing food must be tied together. As such, the effective policy variable in food aid programming is the method of

distribution used in the recipient country.

Grants or donations of food have traditionally been used for individuals who are unable to work such as children, pregnant women, and handicapped adults. Also grants and donations have been used extensively to meet food shortages in times of disaster or emergency. Utilized for these purposes, grants and donations represent a temporary increase in domestic supply which is offset by an increase in demand of similar magnitude since the previously mentioned groups will have a high marginal propensity to consume food. If in fact their marginal propensity to consume food approaches 1.0, the food aid commodities will be added to present consumption, and the market price will be unaffected. The additional real income, represented by the food aid, will make a positive contribution to consumer welfare. Since grants are independent of any attempt to increase production, the main permanent effect is the long-run investment in human capital and any corresponding increase in production at a future time.

A number of studies indicate a positive correlation between nutrition levels and productivity. A 10 percent increase in calories supplied to workers with inadequate diets have produced from 10 to 20 percent increases in output. However, these are measures of increases in productivity when diets were improved for workers engaged directly in the production of goods and services. Still another aspect of productivity overshadows the direct increase in labor productivity in the developing countries. In most developing countries, the problem of reducing unemployment is more pressing

than increasing labor productivity. The examples in this study concentrate on cases with an assumed labor surplus so that emphasis is on increasing employment opportunities and providing social overhead investment to develop resource availability and quality for long-run increases in productivity of all factors. The case of direct increases in labor productivity becomes a special case of those which are discussed. An increase in labor productivity would cause an even greater shift in supply than is discussed in the separate cases and cause an even greater price depression and negative impact on domestic production than is presented.

Although food grants have most commonly been made to very low income consumers, who are generally unemployed or definitely underemployed, grant programs could also be used to distribute food to consumers at other income levels. It is evident from Chapter V that each higher income level results in a greater negative impact on prices and consequently supply as marginal propensity to consume diverges from 1.0. As a result, the lower the grant recipients' income level, the smaller the negative impact on agricultural income. With the exception of the lasting effect of investment in human capital, the impact of grants on welfare is almost exclusively short run. As soon as the grants are terminated, supply and demand revert to their original levels so that further welfare gains are lost. Three possible exceptions should be noted which might result in long-run impacts. First, if grants are continued for an extended period, they may have an impact on consumer tastes and preference so that movement back to previous levels will be vigorously resisted. Second, if food

for grants is contracted under emergency conditions, it probably replaces commercial imports which the recipient country would otherwise be forced to purchase as an alternative to the food aid by diverting foreign exchange from development programs. If so, termination of the food aid will have supply and demand at higher levels than if foreign exchange had been diverted from development programs. Third, the impact on labor productivity may increase income, demand, and supply so that a lasting shift will result.

Distribution of food through work projects results in an impact very similar to grants. Food causes a temporary supply shift and, likewise, income causes a temporary demand shift. However, wages-in-kind produce an additional supply shift as a result of the work output which the food aid finances. Work which is of the overhead investment type results in an additional supply impact which is permanent in nature. The additional supply response shifts the supply curve further to the right than with the grant distribution so that market clearing prices would be lower than under the grant distribution. With price elasticities of demand for food less than 1.0, the lower prices imply lower income to agricultural producers even if supply increases. As with the grant distribution, the negative impact on producer welfare is correlated with income level of the food aid recipients since the higher income consumers generate less demand for food from marginal income than lower income consumers. Consumers, on the other hand, enjoy an increase in level of welfare through the incremental income as an increase in money income and through the lower food prices as an increase in real income.

The impact of food sales is limited to the supply side of the food market. Placing food aid on the market effectively shifts supply to the right without affecting demand. This movement alone would result in reduced food prices and a negative impact on domestic food production. The total effect depends on how the government uses the revenue which it received from the food sales. If the government chooses to use it for social overhead investments in capital improvements to increase agricultural production, the same long-run supply effect could presumably be achieved as with work projects. The capital investment would result in an additional supply shift without an associated demand shift so that equilibrium food prices would be lower than with work projects. Investment in labor intensive overhead such as that supplied through work projects would produce the same supply and demand shifts as with the work project distribution. With the same supply and demand structure as with the work project distribution, the income and welfare implications would also be the same.

The permanent effect of food aid is related to the "investment" which is achieved. With grants the investment is in terms of human capital. With work projects and sales, the investment may be in terms of human capital, but can also be in terms of increased productivity through resource development and refinement. The permanent effect in all three cases is the impact which the "investment" has on production coefficients and the quality of resources which are available. These factors determine the permanent shift in supply and the higher level of output which can be maintained after food aid is discontinued.

Trade restrictions and food aid

The impact which food aid has on a recipient economy is closely tied to the amount of commercial food imports and the rigidity with which they are protected. If the recipient country is willing to reduce imports to balance the market instead of forcing an adjustment in prices, the income and welfare of domestic producers could be protected at the same time that foreign exchange savings are generated. If greater production is the primary objective, with welfare gains for the producer rather than consumer, prices could be maintained by reducing commercial imports by an amount equal to the food aid imports and supply expansion could be achieved through overhead investment. If consumer welfare is of primary importance, maintaining commercial imports will effectively lower prices and raise real income levels. Reduction of commercial imports by an amount less than the food aid would lower prices slightly and increase consumer welfare, and would reduce the negative impact on producers at the same time. The question of whether consumers, producers or both are to benefit from the food aid imports determines the extent to which commercial imports need to be adjusted when they are providing part of the "normal" supply.

The seriousness of reducing commercial imports depends upon the status of the exporting countries affected. With the return on U.S. investment in foreign development being estimated as low as 10 to 15 percent, a large portion of the investment becomes a grant for development. From a global welfare standpoint, reducing third country imports from developed countries may cause other developed countries to contribute to the development effort.

On the basis of optimal distribution patterns developed by Farmingham (37), rice is the only major commodity which is exported from a developing country in any significant volume. Reducing imports from one of the developing nations most likely is saving foreign exchange for one developing country at the expense of another, and may cut off the exporting countries' only source of foreign exchange earnings. A few developing countries export wheat or feed grains, but most of them supply nearby neighbors so that they have a distinct locational advantage over competition from developed nations. The few cases where imports are contracted from developing nations could be protected by only reducing imports from developed nations. The developing nations which are most likely to be affected are Canada and Australia. The U.S. would likely be affected also if commercial exports are not specifically protected as a part of the P.L. 480 contract.

Stimulating agricultural production

Most of the developing countries have, and are projected to continue to have, food deficits in one or more of the major cereal grains. With population expansion increasing at 2 to 3 percent per year, attention is focused directly on expanding food production if any progress is expected in closing the food gap. Food deficits are compounded if economic development results in increased income levels which are then translated into demand for food and other commodities.

Various studies of aggregate production response indicate that producers in the developing countries are responsive to price changes so that any price depression will have a negative impact on supply. Consequently, if

food aid is allowed to depress domestic prices, it can further aggravate the food deficit through a negative impact on production.

Normative supply functions derived under constrained maximization indicate a positive relationship between output and product prices; likewise a positive relationship exists between output and technical coefficients. Normative supply functions also indicate a negative relationship between output and factor prices. These relationships provide a basis for stimulating production or avoiding negative impacts on output. The use of food aid for overhead investments can be effective in increasing the magnitude of technical coefficients as well as the supply of resources. Increases in resource supplies imply a price decline which would further stimulate resource use and output. Food aid offers an opportunity to underwrite labor costs for the development and dissemination of new production technology as well as resource development. Likewise, investments in transportation, market facilities, and storage can utilize food aid and provide a positive impact on permanent supply.

Policy Guidelines

The utilization of food aid to promote economic development must be closely related to (a) the objectives of donor country, (b) methods by which the food is supplied, (c) distributional techniques used to allocate food aid among consumers, (d) income level of the recipient consumers, (e) magnitude of unemployment, (f) extent of food deficit, (g) responsiveness of producers to price changes, (h) concern for pro-

tection of "normal" commercial trade, and (i) the segment of society which is to realize developmental gains. Many of these objectives are similar for all developing countries and indicate that a limited set of policies might be applicable to the group as a whole with minor modifications for specific differences. Such policy implications are direct outgrowths of the economic principles which relate to consumption, production, and development.

Source of commodity aid

The apparent conflict between the protection of third country trade and the development of the recipient country suggests that a unique arrangement is necessary to allow the recipient country to reduce commercial imports when possible. Such an arrangement might include a consortium of developed countries which would cooperate in supplying the food aid and internally negotiate the adjustment in commercial exports on a proportional basis. Such an arrangement should reduce "the accusations from other major exporting countries that United States surplus disposal is cutting into their established, commercial markets" (23, p. 1490). Cost minimizing distribution models indicate that the U.S., Canada, and Australia are the three major surplus countries which should cooperate to alleviate competition. Separate consortiums might be set up for a specific recipient country if countries other than the main three were actually involved in supplying commercial shipments to the recipient country. The consortium arrangement would prevent one surplus country from "dumping" commodities at the expense of other surplus countries. Likewise, the consortium arrangement would involve more than

just one country in the effort and costs of assisting developing countries.

Methods of supplying commodity aid

The basis on which a consortium supplies food to developing countries under concessional agreements should be determined by the role it wishes to play in the development process. In terms of direct return to the consortium, commodities could be sold for hard currency or barter agreement since these two provisions most nearly approach a commercial sale. Most of the developing countries seek concessional sales, however, because they are financially unable to make settlement immediately, and certainly not without diverting finances from other needed investments. In the interest of promoting development, the next closet thing to commercial sales would be hard currency contracts with extended loan agreements. Extended loans allow the recipient to "invest" the food and retire the loans from the return on the investment in development. From the earlier figures representing repayment schedules, the shortest possible repayment period the recipient country could manage and the lowest possible interest rate the consortium would allow minimizes the accumulative value of the liability of a recipient country. By maintaining hard currency agreements for the concessional contracts, the consortium should be less concerned about substitution of food aid for commercial sales since food aid would presumably only result in a longer payoff period than commercial sales.

Project versus program aid

Program versus project aid may well be one of the longest standing controversies in the administration of foreign assistance. The problem

is one of dealing with specific definable projects versus integrated programs which may incorporate numerous projects plus overhead investment to promote interaction. Project aid lends itself to greater influence on behalf of the donor than program aid in general. Since "many governments in underdeveloped countries are not sufficiently strong, or sufficiently responsible, to effectively administer the development plans and projects" (20, p. 895), a consortium might prefer to tie food aid to project agreements. This should be particularly so when dealing with a recipient country with a politically unstable government which would be prone to make short-run as opposed to long-run investments, or with countries which lack the technical manpower to properly analyze long-term investment needs for development. The project approach would allow the donors to exert considerably more influence in the development process by establishing project priorities for which financing would be made available, designing and planning implementation of projects and selecting the sectors and proportion of the aid to be allocated to each. Tying aid to projects would encourage the recipient country to develop a greater quantity and better quality of projects for assistance considerations. Specific identification of financed projects would provide better opportunities for donor countries to publicize their contribution to development. Extended involvement of the donors in analysis of alternative projects and monitoring of their progress would increase access to precise information on recipients' development.

Possible shortcomings of project as opposed to program aid are the reduction in leverage over the total development program and inter-govern-

ment conflicts over supervision of specific projects. In cases where the amount of aid is large compared to the recipient governments total investment in development and projects are numerous, project aid may compare favorably with program aid in terms of total influence. Consequently, project aid provides the donor with close control of specific aspects of the development plan and potential leverage over the general plan through negotiation for future contracts.

Distribution and allocation

For countries without a serious food deficit, grants of food aid to low income consumers would be economically consistent with humanitarian objectives since the utility of an increase in real income would be very high and the demand for food which was generated from the incremental income would most nearly exhaust the extra food supply and minimize the negative effect on prices and production. However, when there is a food shortage in the country so that commercial imports are necessary to supplement domestic supply, the distribution of food aid among consumer groups creates a conflict. Supplying food to unemployed or grossly underemployed individuals will increase their level of welfare through increased real income, but will generate a sizable increase in demand for food at the same time. Consequently, supplying food to very low income consumers results in the least impact on reducing a food deficit or creating a demand for industrial commodities to stimulate that sector. Supplying food aid to consumers with high income levels will generate the least food demand and the most demand for industrial commodities. With marginal

propensities to consume food significantly less than 1.0, a large portion of the food aid will be traded away or substituted for nonfood commodities. The extra food will allow a cut back in commercial imports and free scarce foreign exchange to be used to support the development process.

Distribution of food through work projects which result in a permanent impact on supply will be even more effective than grants in reducing the food deficit. Therefore, work projects would be more effective in reducing demand for commercial food imports than grants. Work projects are also compatible with the project approach to contracting food aid and would be found the most desirable by the donors in most cases.

Open-market sales could be used to distribute the additional food and work projects financed out of the currency which is generated for government use, but this comes much closer to the program approach to aid. When the earnings are generated directly to the government from sales, it is difficult to isolate the income as distinct from other government revenue.

Sales might be particularly appropriate where both food and capital are needed for a project. Part of the food could be sold on the market to generate capital which could be used in turn to purchase the capital goods needed to supplement the food used as wages-in-kind on work projects. For this special case, a combination of the two methods of distribution would be complementary.

On the basis of decreasing marginal utility and the urgency of reducing unemployment in most developing countries, drawing labor from the unemployed or low income groups for work projects is recommended

over an attempt to achieve slightly higher import savings by employing workers from the higher income groups.

Work projects

The range of work projects designed to promote production is extensive. A few examples from Colombia include land clearing, drainage work, and construction of fertilizer plants, access roads, warehouse facilities, and agricultural processing or manufacturing facilities. Examples from Japan include financing of a resettlement or colonization fund, forest development, and construction of factories and markets. Food has been used to finance education, research, and electric power facilities in Pakistan. Electric power development, railroad and highway maintenance, and resettlement projects have made use of food aid in Brazil.

Some projects have much faster payoff than others. For example, land clearing projects can almost finance themselves after a few weeks. The sale of timber from the clearing process provides income to finance continued operation. Within one year the land can be put into use so the regular production is forthcoming by the end of the next cropping season. Other projects such as research and education may have a longer payoff period so that returns are not immediately generated.

Selection of projects should be based on highest marginal returns as related to the total development effort. Achievement of the highest returns requires identification of the physical and institutional bottlenecks which are obstructing development, and the integrated planning of resource use to alleviate these constrictions.

Long-term commitments

In many cases food aid allows the recipient country to reallocate its internal investment program and commit additional resource to development. However, most development projects require several years for completion and the total program is perpetual. It is difficult for the recipient country to determine the extent to which it will be able to maintain financial support for development unless the commitment for food aid is over an extended period of time. With a definite commitment, the recipient country can devote a larger effort to development with reasonable confidence to being able to carry the projects or program to completion. Consequently, it is essential for recipient country planning to have long-run commitments on assistance rather than year-to-year agreements.

Specific projects or plans

Contracts for food aid should be exclusively tied or related to projects or specific plans in a larger program except in the case of famine or emergency relief. Due to the liability for repayment which the recipient accepts, except when provided grants or donations, it is appropriate to encourage the use of food in such a manner that an investment effect will be achieved and the food will not result only in expanded consumption while leaving the country with an increased debt. Associating food contracts with specific projects or plans encourages more precise planning and awareness of alternatives. It also discourages requests for assistance when an economic basis does not exist for its use.

Development commitment versus surplus disposal

Traditionally, P.L. 480 contracts have continued to be labeled as surplus disposal throughout the decade and a half of operation. As such, provision for commodities to be supplied under concessional contract agreements has been basically a function of chance. Given the geographic and cultural differences between the developed and developing nations, the commodities which are in surplus in the developed nations are not always the ones which are in shortage in the developing nations. Consistent with the need in recipient countries of programming food for long-term commitments, obligating support for extended periods actually changes the program from a surplus disposal program to a development program. The extended obligation should be accepted as a claim on donors' domestic production which suggests a possibility for a shift in production to those commodities most compatible with the deficits in the recipient countries. Acceptance of the P.L. 480 commitments as demand for developmental commodities rather than surplus commodities should change the attitude of the donors, recipients, and competing third countries. The development of a responsible attitude on the part of the donor should be conducive to more effective contracting of commodity aid on a need basis rather than a surplus availability basis.

Financing and costs

Financial arrangements associated with commodity aid should be based on maximizing the developmental impact rather than return to the donor if the main objective of food aid is to promote development rather than serve as surplus disposal. The earlier discussion of alternative repayment schedules and interest rates indicates a wide variation in the

long-run impact of commodity aid on the recipient economy. Financing which is favorable to the recipient is consistent with the development philosophy which suggests supplying commodities on a need basis and under long-term commitments.

With or without a consortium arrangement for supplying food aid, the donors should emphasize the gain to the competing exporting countries of having commodities supplied under concessional contracts as opposed to releasing the surpluses on the world market. Schultz estimates that the release of U.S. surpluses, alone, on the world market would have lowered prices sufficiently to lower the total revenue for all sales (71, p. 1022). If Schultz's estimate is correct, supplying food aid as concessional sales was only competitive with total commercial sales and not with revenue from those sales. From the standpoint of the U.S., Schultz estimated that half the cost of commodities which are supplied under P.L. 480 should actually be charged to U.S. agricultural programs and not to the value of the food supplied (71, pp. 1023-1024). In combination, the income foregone by either the U.S. or competing exporters appears to be very low with respect to food aid contracting.

Marginal projects for program expansion

The current provisions of P.L. 480 stipulate that food aid should be programmed for projects which are in addition to those which the recipient country is capable of financing. In effect this requires an examination of the recipient country's development plan and identification of additional productive projects which have not already been specified

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for financing. The theory behind this method of selecting projects for financing is to expand the development plan of the recipient country. In practice, projects which are already in the plan may be better adapted to the use of food as a substitute for capital than a marginal project. In such cases it would increase the substitutability of food aid by tying the food intensive project to a marginal project. Food aid could be used to finance a project which would utilize a high proportion of food, and the capital it frees could be used to finance a marginal project. Combining two projects as a unit would satisfy the theory of expanding the total development effort while achieving practical efficiency.

Food as a policy instrument

As a final note, the essence of using food aid as a policy instrument was aptly captured by Cochrane when he described it as a policy bridge which buys time for adjustment in both donor and recipient countries (20, p. 896). The sale of surplus food on concessional terms serves to alleviate problems associated with surplus supplies of food in the donor country, but fails to treat the cause of the basic problem. Likewise, using food aid to satisfy a food deficit in a recipient country fulfills the short-run deficit but not future deficits. However, as a means to achieving various objectives, food aid can make positive contributions to long-run adjustment. Grant or donation programs most nearly accomplish welfare objectives, while work projects most nearly accomplish development objectives. Sales fall into either group

depending on the price charged for commodities and the use made of revenue. The value of food aid as a policy instrument is determined by its contribution to real per capita income through welfare programs to improve human capital, or development programs to expand domestic production.

INTRODUCTION

The purpose of this study is to analyze the impact of food aid in recipient countries on agricultural and economic development. The central question is: Under what conditions and through what mechanisms are the effects of food aid positive or negative? This study examines (a) the theoretical conditions that result in food aid having positive or negative effects and (b) some empirical evidence of actual impacts of past utilization of food aid. The study draws together theoretical concepts of consumption and production to explain the impact of food aid programs and utilization.

The study analyzes effects of food aid on development in recipient countries with particular attention to the following:

1. The humanitarian aspect of raising real income and nutritional levels of consumers who are at or below subsistence levels;
2. The consumption aspect of increases in real income levels, shifts in demand for consumer goods, allocation of marginal demand between food and nonfood items, changes in quantity demands resulting from relative price changes, and changes through demand on the total economic system;
3. The production aspect of price changes, supply response of domestic producers, and the extent to which these responses reduce the potential impact of food aid on development;
4. The general development aspect of increased employment, multiplier effects of increased income, substitutability of food aid for capital loans, shifts in foreign trade, foreign

exchange balances, and inflation.

Conclusions drawn from the analysis are translated into principles and policy guidelines for effective use of food aid to promote agricultural and economic development.

Problem Setting: Food Balances

For the past several years production of major food and fiber crops in the U.S. has consistently exceeded domestic disappearance. For the last decade the annual excess has been 15.8 - 26.3 million tons of wheat and rye, 4.9 - 34.2 million tons of feed grains (corn, oats, barley, and grain sorghum), and 24.7 - 69.6 million hundredweight of rice. With the exception of 1967, cotton production has exceeded domestic disappearance each year of the last decade with the excess ranging as high as 6.7 million bales in 1963.

Production and domestic disappearance data are not perfect measures of excess productive capacity since net commercial exports also are a part of total demand, but the excess production over domestic disappearnace does suggest effective capability of U.S. agriculture to outproduce domestic demand. Even with government production control policies and programs, the excess of wheat and rye has consistently held between 19 and 26 million tons for the 1964-1968 period. Excess feed grain production reached recent lows in 1961 and 1964, but in 1967 exceeded the previous high by more than 8.0 million tons. Rice production has exceeded domestic disappearance by steadily increasing amounts since 1961 with the exception of 1964. Not only has U.S. agricultural output

Table 1. Production and domestic disappearance of selected agricultural commodities in the U.S.[a]

Year	Wheat and rye (1,000 tons)			Feed grains (1,000 tons)		
	Produce	Disappear	Excess	Produce	Disappear	Excess
1950	31,180	20,940	10,240	113,131	109,468	3,663
1951	30,247	20,719	9,528	104,786	109,759	-4,973
1952	39,647	19,896	19,751	110,958	100,521	10,437
1953	35,721	19,229	16,492	108,303	101,940	6,363
1954	30,245	18,644	11,601	114,073	102,162	11,911
1955	28,928	18,445	10,483	120,846	109,275	11,571
1956	30,758	17,944	12,814	119,308	106,943	12,365
1957	29,470	18,092	11,378	132,424	113,417	19,007
1958	44,653	18,613	26,040	144,121	123,536	20,585
1959	34,280	18,435	15,845	149,605	130,198	19,407
1960	41,642	18,627	23,015	155,618	133,216	22,402
1961	37,812	18,816	18,996	140,626	135,748	4,878
1962	33,952	17,897	16,055	142,899	132,848	10,051
1963	35,078	18,254	16,824	156,432	130,472	25,960
1964	39,652	20,014	19,638	134,200	127,472	6,728
1965	42,951	21,406	21,545	157,400	141,332	16,068
1966	40,129	21,087	19,042	157,600	140,760	16,840
1967	46,350	20,067	26,283	176,000	141,804[b]	34,196[b]
1968[b]	47,742	23,176	24,566	168,100	---	---

[a]Source: (81, 82, 83, 85, 86, 87, 88, and 89).

[b]Preliminary.

Table 1. (Continued)

Year	Rice (1,000 cwt)			Cotton (1,000 bales)		
	Produce	Disappear	Excess	Produce	Disappear	Excess
1950	38,840	25,752	13,088	9,851	10,536	- 685
1951	46,122	24,159	21,963	15,028	9,231	5,797
1952	48,278	25,149	23,129	15,124	9,511	5,613
1953	52,924	25,312	27,612	16,359	8,651	7,708
1954	64,254	27,976	36,278	13,545	8,901	4,644
1955	55,969	27,080	28,889	14,633	9,210	5,423
1956	49,503	25,993	23,510	12,977	8,608	4,369
1957	42,954	25,658	17,296	10,863	7,999	2,864
1958	44,775	25,617	19,158	11,373	8,703	2,670
1959	53,669	27,750	25,919	14,505	9,017	5,488
1960	54,623	26,944	27,679	14,353	8,279	6,074
1961	54,221	29,570	24,651	14,384	8,954	5,430
1962	66,100	28,000	38,100	14,867	8,419	6,448
1963	70,300	28,700	41,600	15,334	8,609	6,725
1964	59,800	28,200	31,600	15,182	9,171	6,011
1965	76,300	30,900	45,400	14,973	9,497	5,476
1966	85,100	31,900	53,200	9,575	9,485	90
1967	89,400	33,600	55,800	7,458	8,982	-1,524
1968[b]	105,300	35,700	69,600	10,948	8,246	2,702

exceeded domestic demands in the past, but the data for the most recent years indicate a rising trend in production relative to domestic disappearance.

Surplus production capacity is not unique to modern U.S. agriculture. The Agricultural Adjustment Act of 1933 (93, p. 31) was enacted specifically to "establish and maintain a balance between production and consumption." Although "surpluses" were not explicitly mentioned in the A.A.A. of 1933, they were implicitly recognized as a contributing factor when Congress was prompted to pass legislation for the specific purpose of expanding consumption while promoting production adjustment of selected basic commodities (wheat, cotton, field corn, hogs, rice, tobacco, milk and milk products). The following year "surpluses" were explicitly mentioned in legislation when the A.A.A. of 1933 was amened "to enable the Secretary of Agriculture to finance...surplus reduction" of basic commodities (expanded to also include cattle, rye, flax, barley, and grain sorghum). Surpluses were further acknowledged by the establishment of the Federal Surplus Relief Corporation in October of 1933 under the authority of the National Industrial Recovery Act of June 1933 (92, p. 195). In the first annual Report of Federal Surplus Relief Corporation covering October 1933 to December 1934, the operations of the Corporation were cited as having "resulted in a substantial movement of price-depressing surplus agricultural commodities from the farmers to consumers on relief, to the benefit of both" (69, p. 1).

Creation of the Commodity Credit Corporation (C.C.C.) in October 1933 by Presidential Executive Order (79, p. 73) represents the beginning of the second concept of surpluses. Surpluses referred to in the A.A.A. of 1933 represented surplus production held by the farmers or offered on the market for unusually low prices. Although closely related, the second concept is distinctly different and relates to stocks of commodities held by the C.C.C.

During the early stages of C.C.C. price support programs, stocks were accumulated but at levels that were considered reasonable to protect against emergencies and to carry out price stabilization policies of the government. By the early 1950's C.C.C. stocks had accumulated, as Egbert stated, "to a level far above conceivable emergency requirements" (26, p. 1), and the second concept of surpluses came into use. The U.S. entered a state where not only did U.S. farmers outproduce commercial demand, but the government often accumulated stocks far above estimated emergency reserves.

In May 1956 Congress passed Public Law 540 which, in Section 201(b), instructed the Secretary of Agriculture to report annually on disposal of C.C.C. stocks. The report is required to show "(a) the quantity of surplus commodities on hand, (b) the method of disposition utilized and the quantities disposed of during the preceding twelve months, and (c) the method of disposition to be utilized and the estimated quantities that can be disposed of during the succeeding twelve months" (84, p. 1). A summary of the surplus commodities and the estimated quantities which the U.S. had available for disposition during Fiscal Year 1969 is listed in Table 2.

Table 2. Surplus commodities available during fiscal year 1969[a]

Commodities	Units	Quantity
Wheat and rye	(tons)	8,429,115
Feed grains	(tons)	17,861,952
Rice	(cwt)	11,181,878
Cotton	(bales)	709,695
Tobacco	(tons)	17,500
Fats and oils	(tons)	281,441
Oilseeds and meal	(tons)	1,786,121
Dairy products	(tons)	719,753
Fruits and vegetables	(cwt)	300,000
Honey	(tons)	4,822

[a]Source: (84, pp. 17-28).

At the same time that U.S. agriculture is outproducing commercial demand and the U.S. government is holding excess stocks of food and fiber commodities, many of the developing nations of the world are experiencing food deficits. F.A.O. reports the average annual deficit of all grains (wheat, rye, barley, oats, maize, sorghums, millets, and mixed grains) for the 1961-1963 period was 5.3 million tons in Latin America, 1.3 million tons in Africa, 2.9 million tons in the Near East, and 7.6 million tons in the Far East (32, p. 86). F.A.O. projects the annual deficits to grow to 7.5, 6.2, 5.5, and 17.5 million tons respectively for the four regions by 1975 if past area and yield trends continue.

In 1964 the Foreign Regional Analysis Division of U.S.D.A. projected 1970 grain deficits of 4.7 million tons in Latin America, 7.6 million tons in Africa, 11.4 million tons in the Near East, and 11.9 million tons in the Far East (90, pp. 97-98). Abel and Rojko, in their 1967 analysis of the world food situation, estimated 1970 grain deficits of 10.0 million tons for India, 3.4 million tons for Pakistan, and 25.2 million tons for the remaining less developed countries (excluding those which are projected to be net exporters) using the 1954-66 trends for the projections (2, p. 12). Modifying the historical trends by assessing the likely impact of agricultural policies and development plans had little effect on their 1970 trend projections. The modified projections affected their projections only for India and Pakistan, lowering projected deficits in these countries to 6.7 and 2.5 million tons respectively.

Using a combination of F.A.O. and U.S.D.A. trend assumptions and modifications for population growth, production increases, and demand growth rate, Blakeslee (11) and Framingham (37) projected "most probable" 1970 food grain deficits of 8.1 million tons in Latin America, 13.5 million tons in the Middle East, 8.0 million tons in Africa (excluding South Africa), and 8.2 million tons in India and Pakistan. Although there are some differences in the magnitude of estimates of future food deficits in the developing countries, each of the studies projected deficits of approximately 35-40 million tons per year, for the 1970's. In addition, food deficits may be even greater in the developing

countries than the above projections, since they are basically projections of effective demand. For example, F.A.O. statistics indicate that effective demand was providing an average daily calorie intake of 2,210 in Africa, 2,190 in the Near East, and 2,080 in Asia and the Far East in 1962 when an adequate nutritional diet would have required 2,250 in Africa, 2,330 in the Near East, and 2,230 in Asia and the Far East[1] (32, p. 36). Abel and Rojko estimated 1959-1961 daily calorie deficits of 240 for India, 180 for Pakistan, and 160 for the other less-developed countries (2, p. 7). These food deficits arise from two sources in the developing countries--the inability of domestic agriculture to satisfy effective demand and the absence of adequate purchasing power among a segment of the population to provide minimum nutritional requirements.

Solutions to the projected food deficits in the developing countries are divided into two categories. Satisfying effective demand requires expansion of domestic agriculture or development of export earnings which can finance food imports. Although numerous countries are attempting to become self-sufficient through expanded domestic production, a combination of production and imports may be the long-run economic solution. As Beringer points out, "On the basis of long-run comparative cost considerations it may well turn out that at least a certain portion of total food-grain needs should be met through imports from abroad in exchange for goods which can be produced more advantageously at home" (9, p. 321). Narrowing the gap between effective demand and adequate

[1]Estimated requirements vary according to climate, age of population, and weight of individuals.

nutritional requirements, according to Blau, "depends essentially on progress made in raising the efficiency of production and distribution systems to the mutual benefit of consumers and producers, and, on the other hand, raising the levels of both general and external purchasing power" (12, p. 1). Essentially the solution to food deficits and malnutrition in the developing countries lies in the development of domestic agriculture or expanded foreign trade to satisfy effective demand. The latter course implies an expansion of the general economic and effective demand for land.

The basic question is whether or not the abundant productive capacity and food surpluses of the U.S. can be used effectively to meet immediate food deficits in the short run and to promote agricultural and economic development in the long run. Khatkhate strongly supports the use of surplus commodities from developed nations to meet food deficits in developing nations. He states that "commodity imports under the foreign aid program should be a boon to underdeveloped countries" (57, p. 192). In a similar statement, Ezekiel proposes the use of U.S. surpluses to both satisfy food deficits in the developing nations and to bring about economic development. "Heavy surplus disposals to these areas over long periods, if accompanied by corresponding speeding up of their general economic and industrial development, might help advance the day when they could begin to depend on industry as well as agriculture as substantial factors in both production and trade" (27, pp. 1075-1076). In a later statement Ezekiel pointed out that the use of surplus commodities "in helping to finance economic development can be an important contribution to the more rapid development

of underdeveloped countries, except for any countervailing influence on retarding their agricultural development" (27, p. 1077). Schultz has called attention specifically to the "potentially serious long-run adverse effects" of surplus commodity disposal upon agriculture of the recipient countries (71, pp. 1027-1029). Writing on the P.L. 480 program in Colombia, Goering stated that "Surplus farm stocks are viewed as potential assets in the war against hunger and poverty" (39, p. 992).

Benedict and Bauer summarized the essence of the food problem in their study of U.S. surpluses. "To many, it seems obvious that both of these problems could be solved by an enlightened policy of sharing our abundance with the needy peoples of other countries" (8, Forward). Reporting his analysis of P.L. 480 to the Senate Agriculture and Forestry Committee, Humphrey wrote "America's abundance of food and fiber is a tremendous asset in the world's struggle for peace and freedom--an asset still awaiting to be fully utilized with greater boldness and compassion" (48, p. 1). Cochrane suggested a general solution to the food problem in his President-Elect Address to the American Farm Economics Association. "The transfer of surplus food and fiber supplies from the United States and their conversion into development supplies in underdeveloped countries becomes the policy bridge whereby the pressure of food and fiber supplies on population in the United States is moderated and the pressure of population on food and fiber supplies in the underdeveloped countries is moderated. By this policy bridge we buy the kind of adjustment time required in each social complex; and its construction would constitute political

action at its best" (20, p. 896). These are only a few statements representative of the widely held belief that surplus commodities from the U.S. can be useful in aiding developing nations to meet both short- and long-run food problems, but that caution must be exercised to avoid adverse effects on the recipient economy. Presently the world food problem is one of excess stocks in the U.S. and other developed countries while chronic shortages occur in many of the developing nations.

Clearly defined, the problem is one of disposing of U.S. surpluses, and at the same time satisfying current food deficits in developing nations in a manner consistent with achieving long-run food balances as well. Although "the people of the United States have demonstrated repeatedly that they can be very generous to those in temporary distress, ...they will not be satisfied with any program that does not look to eventual termination of demands on them, except in times of emergency or widespread disaster" (8, p. 5). In his analysis of Food for Peace, Toma cites Freeman, Secretary of Agriculture, as "warning the under-developed nations not to expect continuous unlimited food assistance from the United States " (75, p. 138).

If the U.S. is unwilling to supply perpetual food donations, even of surplus commodities, the solution to the problem apparently lies in the realm of at least a quasi-commercial agreement for supplying the surpluses combined with effective utilization of the commodities to promote economic development and generate proceeds to meet the obligation of additional imports until production can be brought into balance with demand. One innovation in that direction was the Agricultural Trade Development and Assistance Act (P.L. 480) of 1954.

Through 1968, $17.6 billion of surplus U.S. farm commodities had been shipped to recipient countries under P.L. 480 agreements. The magnitude of the P.L. 480 program indicates a significant potential to produce beneficial or harmful effects on recipient countries, depending on its use. To achieve efficient and beneficial effects from P.L. 480, theoretical aspects and past experiences need to be examined and analyzed carefully in order to develop or modify administrative guidelines which direct the program.

Review of Related Studies

F.A.O. pilot study of India

In 1955 F.A.O. published a comprehensive study conducted by a team of economists under the leadership of Dr. Mordecai Ezèkiel to evaluate the alternative uses of surplus commodities to finance economic development (34). The pilot study was conducted in India to determine how surplus farm commodities could be used to finance additional investment without competing with sales of domestic products or usual exports from other countries.

The study outlines four classes of projects in which surplus commodities could be used. Type I projects distribute food as wages-in-kind with all additional food being consumed by those receiving the food or their families. Type II projects provide for sale of surplus food on the open market with the proceeds being used to employ additional labor on various development projects. Type III projects are similar

to Type II except that they have opportunities for rapid return[1] so that proceeds from the project could make it self-supporting, or at least cover nonfood expenditures on the project. Type IV projects are groups of projects which are referred to as the program approach. A Type IV program includes the integration of two or more projects as a part of a comprehensive development plan.

Based on a set of assumptions and coefficients for the Indian economy, the study proceeds to estimate the total need for surplus food as a portion of the total increase in investment through the alternative projects. It concludes that if provisions are made to prevent resale of the surplus commodities, or substitution of the commodities for domestic purchases, Type I projects could utilize surplus commodities up to the amount of the total labor cost of the project without depressing food prices (34, p. 7).

Based on a Type II project which requires 70 percent of the total cost as direct labor, a given a marginal propensity to consume food of 0.40 and marketing and transportation costs of surplus food equal to 15 percent of the value, direct demand for food equal to only 24 percent of the project investment would be generated.

However, further assuming that 10 percent of the investment is for imported materials and equipment and 20 percent is for domestic products, additional food demand is generated from the increased income for

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[1]Projects which fall into this class are generally those which tap reserves of natural resources such as ore or timber.

domestic producers.[1] Assuming that allocation of marginal income will be 9 percent for savings, 9 percent for taxes, 8 percent for consumption of imports, and 35 percent for food purchases of which 25 percent is marketing and transportation costs, the 49 units of derived income generate 13 additional units of food demand. Tracing the process through three years, the total demand for additional food reaches only 52 percent of the initial investment even though direct labor represented 70 percent of the project costs.

Type III projects, as discussed in the study, are a special case of Type II projects where the project actually finances itself in part or total after a short initial period of operation. If the project is capable of producing part of its own financing, it reduces the amount of capital investment needed to support the project.

Using a Type IV program example requiring 50 percent of the costs as direct labor, the potential demand for surplus food (assuming the same estimated coefficients as with the Type II project) was estimated to equal 48 percent of the program investment in the first three years.

The second part of Ezekiel's study was devoted to discussion of specific projects which could be undertaken in India. Projects appropriate for Type I financing include educational food scholarships (particularly for the rural youth and children from low income families), food scholarships to special groups (i.e., displaced persons

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[1]The study points out that additional income can be spent in three ways--more goods sold at the same price, the same amount of goods sold at a higher price, or increased imports (34, p. 9).

and the backward classes),[1] internships for educated individuals to obtain work experience, village or community development projects (i.e., building schools, wells, village tanks, gutters, dams, access roads, irrigation canals, warehouses, and conservation terraces), and financing milk marketing schemes (i.e., arrangements for collection, chilling, processing, and shipment of milk, movement of families and their milk animals out of the cities, and supplementing milk supplies with imported milk). Type II examples include road construction, new irrigation projects, reforestation, erosion control, and other development projects which employ unskilled labor. A Type III project which was suggested involved extension of a road into a virgin forest area and the development of integrated forest industries.

Michigan State study of Colombia

In a study published in 1963 (40), Goering and Witt analyzed the impact of the P.L. 480 program on the agricultural economy of Colombia. The study considered the potential impact of P.L. 480 imports on four areas of the economy: (a) farm prices, production, and income, (b) economic development and internal resource use, (c) level of consumption of agricultural products, and (d) changes in Colombian foreign exchange expenditures. Comparing domestic prices and production in 1954-55 and 1959-60 of commodities supplied under P.L. 480 agreements with the prices and production of agricultural and nonagricultural commodities not in the program, they concluded that production of wheat

[1] Backward classes include two groups given special legal recognition. One of these is the primative and traditional tribes, and the other is religious or social groups affected by prejudices.

increased only slightly over the five year period while cotton production increased over 25 percent per year. As with cotton, sesame production increased substantially even though P.L. 480 imports of edible oils, a close substitute for sesame, were large relative to domestic production. The authors concluded that there is a strong indication that the national food procurement agency (I.N.A.) used P.L. 480 wheat imports to satisfy domestic demand at reduced prices rather than to undertake a costly price support program which would have stimulated production. At the same time an active price support program was carried on for barley with the apparent impact of shifting domestic production from wheat to barley.

Goering and Witt point out that local currency use can only contribute to economic development if the 'appropriate' environment exists, i.e., that resources are available but unemployed because of monetary and fiscal rigidities (40, p. 22). They conclude that it is generally agreed that 'appropriate' conditions have prevailed in Colombia--the labor force is increasing faster than the new employment opportunities, thus creating unemployed resources which have been put to work on development projects financed with P.L. 480 loans--and that the use of local currency has not created undue inflationary pressures on the economy.[1] The study concludes that availability of local currency loans probably was instrumental in stimulating expansion of

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[1]The Colombia authorities have been uneasy about an annual increase in the price level of under 10 percent, but this compares favorably with the 400 percent in Brazil, 439 percent in Argentina, and 1,110 percent in Chile for the period from 1954 to 1960 (40, p. 23).

the total development program in view of the conservative fiscal policy demonstrated in the past.

While the general level of food prices increased by 64 percent, 6 percent more than general price levels, retail bread price increased 40 percent, vegetable shortening price increased 117 percent, and cotton cloth price increased 36 percent. At the same time P.L. 480 imports of wheat, edible oils, and cotton represented 20, 11, and 9 percent respectively. Although P.L. 480 imports may have helped to hold down retail prices, the effect was difficult to measure because of the concurrent influence of domestic price support programs. High support prices may have had an equally significant effect by increasing production and contributing to increased processing efficiency and lower marketing spread through higher volume processing.

The impact of P.L. 480 donation programs was more difficult to evaluate. It was observed that child consultation at health centers decreased by 50 percent due to CARE school and family feeding activities. School attendance was maintained at unusually high levels by distributing milk, cheese, and rolls.

Observation of market sales before and during large donation programs led the authors to conclude that delivery of surplus commodities to those with nominal purchasing power resulted almost exclusively in expanded consumption and not displacement of regular purchases. Consumer purchases in areas with large surplus food programs did not decline in any of the markets after the programs went into effect.

The study points out that an important side effect to the voluntary agency programs may be the development of greater sensitivity by the

government to the needs of the destitute and refugee groups. Another side effect may be a shift in tastes and preferences as the result of promotional programs associated with surplus commodity distribution to promote more nutritional diets.

Aggregatively, the authors found that P.L. 480 programs have contributed 52 calories per day to per capita consumption in Colombia. On the average this amounted to a 2.4 percent increase, but many families were certainly affected much more significantly.

The final area examined was impact of P.L. 480 shipments on competing third country trade. The authors conclude that there are strong implications that P.L. 480 has had a negative impact on commercial trade. Peru experienced a fall in cotton exports to Colombia. Since total cotton imports fell, the absolute fall is not proof of negative impact, but Peru's share of the market fell as well. Canadian wheat shipments have fallen significantly also. Their shipments to Colombia fell to only 32 percent of the preprogram levels, giving a strong indication that the P.L. 480 program did have a negative effect. The authors suggest that this might be viewed as Canada's contribution to the development program in Colombia.

U.S.D.A. study of U.A.R.

In a study of P.L. 480 in the U.A.R., Umstott concluded that P.L. 480 shipments to the U.A.R. were closely related to a shift from a 7 percent cost of living increase between 1955 and 1961 to a 5 percent decrease between 1961 and 1962 (76, p. 11). The U.A.R. was producing about 54 percent of its estimated wheat consumption in 1958 when the daily per capita food consumption averaged 2,340 calories. Umstott

projected that domestic production would provide less than 44 percent of the 1966 consumption, and that demand for P.L. 480 wheat imports would rise considerably. He concluded that since the agricultural resource base is quite limited in the U.A.R., the government would be forced to look to industrial development as a source of foreign exchange earnings. This would lead to increased employment and directly to greater food demand. Consequently, projections to 1970 indicated an even greater demand for commercial or concessional food imports for the U.A.R. In terms of program size, Umstott points out that the Title III program in the U.A.R. during 1961 to 1963 was the largest of any recipient country. School feeding under Title III reached about three million children.

In addition P.L. 480 shipments, equal to 12 percent of the total U.A.R. imports in 1961, eased the serious drain on foreign exchange by calling for payment in local currency. Local currency sales allowed the U.S. to expand their exports significantly to the U.A.R. by overcoming two major obstructions to trade: limited foreign exchange and lack of U.S. demand for U.A.R. commodities. Acceptance of soft currency reduced the need for U.A.R. exchange commodities to supplement foreign exchange purchases.

Using a simple demand prediction equation where change in demand (d) equals the annual rate of population change (p) plus the product of the per capita increase in income (g) and the income elasticity of

the demand for food (n),[1] Umstott projects a growth in food demand of almost five percent per year. Assuming agricultural output continues to increase at 1 percent per year, he projected an annual food deficit of 4 percent.

U.S.D.A. sponsored study of Turkey

The team study of Turkey (4), directed by Dr. Resat Aktan, concentrated on the evaluation of the economic impact of P.L. 480 Title I programs through 1962. Two commodity groups constitute the majority of the program with wheat making up 63 percent, fats and oils 25 percent, and various other commodities providing the other 12 percent.

The study characterizes Turkish agriculture as having traditional production patterns which are hampered by fractionalization of land holdings through inheritance.[2] Lack of social overhead structures such as credit, transportation, schools, advisory service, and marketing facilities further hinder the transition to a dynamic agriculture. The farmers most involved in the money market are those producing fruits, vegetable, and industrial raw materials such as cotton, tobacco, and oilseeds.

On the basis of price index comparisons, the study concludes that farm prices rose at about the same rate as general prices during the

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[1] Parameters used for the U.A.R. were: $p = 3.0$, $g = 2.67$, $n = 0.7$, and $d = p + gn = 4.87$.

[2] Less than 5 percent of the farmers have a farm wholly in one piece.

P.L. 480 era, and that there is no evidence that P.L. 480 imports had an adverse effect on domestic production of imported products. These results were observed under conditions where annual imports represented the following percentage of domestic production: wheat 1.5 - 13.5, corn 1.0 - 6.0, rice 5.0 - 11.0, and vegetable oils 12.0 - 60.0

It was observed that official attitudes toward agriculture have not consistently given it priority and integrated programs needed to make it a significant contributor to economic growth. Consequently, it was concluded that P.L. 480 commodities helped to prevent a food crisis of major proportion. The study examines hypothetical production adjustments which might have taken place if P.L. 480 commodities had not been available, but discounts them heavily because of the uncertainty of the direction which the government would have moved in the absence of P.L. 480 assistance.

Several approaches were taken to analyze the price and income effects on consumers. By examining several price indices, the research team determined that wheat and vegetable oils constitute about a third of the food-price index and 13 to 15 percent of the total cost-of-living index. Thus, any price effects due to P.L. 480 imports would have a significant effect on consumer cost of living. An examination of seasonal price changes indicated that during the period of P.L. 480 imports, prices at harvest time rose relative to the rest of the year.

An application of supply elasticities to food deficits, under the assumption that all P.L. 480 imports were additional, indicated that the price of wheat would have risen by 10 to 60 percent in the absence of P.L. 480 imports. Downward adjustments must be made on these price

estimates to compensate for the one third to one half of the local currency proceeds which were used for U.S. government expenditures. Most of these expenditures would have been made anyway so that dollars would have been available to purchase wheat and vegetable oils commercially and meet part of the food deficit.

The study concludes that many structural changes in demand can be attributed to P.L. 480 imports. The declining price trend for margarine was stabilized by expanded demand. Butter price, in contrast, reversed its rising trend and fell slightly during the 1955 to 1959 period. Agriculture's share of national income declined from 49 percent before P.L. 480 imports to 40 - 42 percent in 1961 and 1962 even though the gross value of production climbed fairly regularly even when adjusted for constant prices. Large imports of cereals would have suggested a relative loss by cereal farmers as compared with livestock farmers, but no evidence was found in the data to suggest such a conclusion.

Food expenditures were estimated to range between 40 and 70 percent of consumer budgets for the 1948 to 1962 period, when food consumption was estimated at 2500 to 2800 calories per day. Wheat supplied under P.L. 480 tended to be consumed in the cities and coastal areas while corn and vegetable oils (as margarine) were distributed more evenly over the country. Together, the wheat and vegetable oil imports under P.L. 480 represented 10 to 20 percent of food expenditures. Complex mixing rates were used to stretch or contract the wheat supply by varying the wheat to rye ratio.

Economic development also reflected the impact of P.L. 480. Investment resulting from P.L. 480 has aided in the development of domestic

consumer good industries which replaced imports of many consumer goods. Many of the new industries are still in their infancy, but it appears that they will be able to compete effectively and provide import substitutes in the future. The study concludes that expenditure of local currency increased demand for imports to some degree, but did not significantly shift trade patterns.

It was observed that P.L. 480 shipments assumed a major role in balancing international accounts. An average of 34.5 percent of the annual deficit was satisfied with P.L. 480 imports. However, because of large allocations of local currency for U.S. Government uses, the net effect on balance of payments must be adjusted downward to account for loss of dollar earnings.

Arizona study of surplus disposal

A general study of the impact of P.L. 480 on receiving nations was conducted by Menzie, Witt, Eicher, and Hillman (65, Chapter V). The early part of the study points out that a development plan is essentially an investment plan in recipient countries. The greater the food aid program, the more planning that is necessary for a unified investment plan.

The study notes that India moved toward increased P.L. 480 Title I imports because of projected food shortages and lack of foreign exchange to transact commercial purchases. It was determined that food would become the limiting factor in the Third Five-Year Plan, and that domestic resources could only be pushed to the limit of the total food supply. Consequently, large food imports were critical to the success of the development plan.

The case of Title I shipments to Israel differs from many of the other developing countries. Israel already had a per capita income of almost $600 in 1956, a stage of development considerably advanced from India and other recipient countries. Limited arable land and high irrigation costs constrained production of wheat and feed grains. P.L. 480 imports of wheat and feed grains permitted a rapid expansion of the livestock industry and aided in relaxation of rationing on eggs, diary products, meat and poultry. Even dollar aid to Israel would necessarily have been used to purchase increased volumes of feed grains. Under these conditions, P.L. 480 aid served as a close substitute for other forms of financial aid. Although all of the imports did not meet the 'additional' condition, consumers benefited greatly from P.L. 480 imports at the partial expense of commercial exporters in other countries.

The Colombian experience is summarized as resulting in lower wheat prices which caused a shift in production from wheat to barley, as mentioned earlier in the summary of the Goering and Witt study (40). The shift was made relatively quickly with only slight income effects on Colombian agriculture.

Examples of Title II programs which utilize food as wage payments are discussed using Tunisia as an example. Basically, work projects have been designed to develop a social overhead structure of roads, railroads, schools, power plants, and irrigation facilities in rural areas. The work projects originally provided about two thirds of the salary in food (wheat) and the other third in cash. Part of the cash was spent on additional food and part was used for nonfood items

creating additional demand for domestic food and nonfood commodities. By November of 1961 nearly 200,000 workers were employed full time on various work projects in Tunisia. Success of the work projects is attributed primarily to the high quality of local planning and administration. Other countries which have conducted major work project programs include Morocco, Afghanistan, Korea, Dahomey, Ethiopia, Iran, Tanganyika, India, and Libya.

The Menzie, et al. study generalizes the P.L. 480 impact by pointing out that concessional commodity imports appeared to reduce commercial grain imports in Israel and Colombia. The inflow of commodities to Colombia coincided with a sharp drop in world coffee prices and enabled the Colombian government to avoid difficult decisions relating to capital import reductions which would have slowed down development.

The study concludes that for two basic reasons food aid is not a perfect substitute for dollar aid. First, most investment programs do not require only wages or labor costs, for which food can be substituted. Normally, other supplies and equipment are needed which must be purchased with cash. Second, even if labor represented 100 percent of the investment costs, marginal preference of the consumer is usually such that additional food demand will not exhaust the wages. In this case part of the surplus food used to finance a given project would find its way into the market system and create a depressing force on domestic prices. Early studies indicated that as high as 50 percent of additional development costs could be financed with surplus food, but recent studies have indicated that the proportion may go as low as 20 percent.

Lucknow study of India

The Srivastava study (73) is divided into four major parts. Part I establishes the theoretical relationship between food aid and growth of the Indian economy. The theoretical section is followed by a summary of composition and magnitude of P.L. 480 shipments to India. Part II analyzes the commodity impact on domestic prices, production, and consumption. Part III analyzes the local currency impact of the program, and Part IV examines the balance of payment aspect of the P.L. 480 shipments.

Srivastava points out, in the theoretical section, that acceleration of growth to achieve higher per capita income necessarily requires large volumes of investment. A sizable portion of the investments result in direct wage increases or increases in derived income. When combined with high marginal propensities to consume and high income elasticities of demand for food, the rising incomes result in major increases in aggregate demand for food. Unless supplementary supplies of food are forthcoming, prices will be driven upward in an inflationary spiral which seriously reduces any gain in real income levels. In such a case, food aid can serve as a temporary buffer between domestic supply and demand so that gains in money income can be realized as gains in real income levels as well. Consequently, the value of food aid relative to dollar aid is closely related to the performance of the agricultural sector in the recipient country.

The impact of P.L. 480 shipments is related to the responsiveness of marketed surplus to price changes. Srivastava cites estimates of short-run price elasticity by Raj Krishna as 0.1 for wheat and bajra,

0.2 to 0.4 for maize, sugarcane, and rice and up to 0.6 to 0.7 for cotton. Long-run elasticities for the same commodities range from 1.5 to 1.6 (73, p. 51). Given the responsiveness of farmers to price changes, it is concluded that three aspects of price policy must be present to successfully utilize food aid without negative effects on domestic production.

1. A minimum level of price supports must be guaranteed.
2. Inter-crop price parity must be maintained to achieve simultaneous production of all crops at desired level.
3. Price supports must take account of regional cost advantages or regional shifts will result. Use of concessional imports can effectively control excessive rises in prices.

In contrast, price supports may conflict directly with consumer oriented objectives to lower retail food costs. In cases where food consumption is below recommended minimum requirements, lowering retail prices may be an effective means of increasing calorie intake and labor productivity. Srivastava cites findings which indicate that on the average a one percent increase in calorie intake will produce a 2.27 percent increase in labor productivity (73, p. 97). The study indicates that P.L. 480 imports have had a significant impact on low income groups where sizable deficits had existed between actual and recommended consumption.

Turning to the monetary aspects of P.L. 480, the study suggests that currency proceeds from P.L. 480 sales have a direct impact on the money supply and budget position of the recipient government. The time lapse between deposit of rupees in the U.S. Embassy account and their

release as loans or grants determines the impact on the money supply. It is concluded that P.L. 480 operations in India have had a neutral effect on the money supply between 1956-1957 and 1965-1966 when deposits and withdrawals are considered simultaneously. However, it is observed that termination of P.L. 480 imports could result in an expansion of the money supply as accumulated stocks of rupees are spent for U.S. uses and Cooley loans. The availability of P.L. 480 funds has reduced the budgetary deficit by an average of 4.8 percent per year. If an inflationary impact on the money supply is to be avoided in the future, resources will have to be mobilized to meet the budget deficit and also to equal the U.S. use of impounded soft currency.

In analyzing the use of P.L. 480 rupees, Srivastava suggests that the impact of investments is subject to a multiplier effect. The income-expenditure lag has a direct impact on the total development impact which will occur in the first, second, and subsequent years. The study considers expenditure lags of 2.4, 3.0, and 4.0 months for five, four and three rounds per year respectively. Srivastava cites Khusro for evidence to support 3.0 months as the realistic estimate for India (73, p. 165). Likewise, the marginal propensity to consume, estimated at 0.8 in India, has a direct impact on the total multiplier effect. For simplicity, the monetary leakage is neglected on the assumption that taxes are instantaneously respent by the government and balance-of-payment deficits are met by grants or loans. The study concludes that even with the extreme assumption of five spending rounds per period, the supplies of food under P.L. 480 have far exceeded the additional demand for food generated from P.L. 480 investments.

Srivastava points out that a paradox surrounds the evaluation of foreign exchange or balance-of-payment benefits of P.L. 480. To the extent that P.L. 480 commodities replace hard currency purchases, P.L. 480 commodities are a direct substitute for hard currency and represent direct foreign exchange savings. However, P.L. 480 commodities are contracted under provisions which prohibit the displacement of commercial sales by the P.L. 480 shipments. In theory, then, no balance-of-payment benefits can be attributed to P.L. 480 shipments, but in practice benefits do accrue to recipient countries. The two major sources include the interpretation of 'normal' imports and periodic displacement of commercial exports.

Another area of P.L. 480 impact is the extent of U.S. use of P.L. 480 soft currency in the recipient country. P.L. 480 authorizes up to 25 percent of the soft currency to be used for U.S. uses. The extent of this negative impact depends upon the total expenditure of soft currency for U.S. uses, and more specifically that portion of those expenditures which would have been made if the stock of local currency had not been available. The study concludes that P.L. 480 aid to India has had a significant effect on the foreign exchange constraint, but that the real gain did not exceed more than 75 percent of the total aid.[1]

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[1]The study implies that 80 percent (75 percent net gain to foreign exchange plus 4.55 percent loss from U.S. uses equals 79.55 percent gross gain) were displacements for commercial sales which would have been made in the absence of P.L. 480 (73, pp. 192-199). At this rate, practice has deviated significantly from theory (or intent) and P.L. 480 has been allowed to displace commercial sales to India in the amount of 27.855 million metric tons over the period from 1956 to 1965 (73, p. 192).

Summary

This review provides examples of the types of studies which have been undertaken, major issues which have been examined, and the nature of conclusions which have been reached.[1] The literature includes analytical work ranging from theoretical studies, such as the Ezekiel study, which attempt to predict aggregative or macroeconomic impacts of P.L. 480 on the recipient economy, to empirical analysis such as the Umstott study which tend to summarize quantities and values of commodities only to place them in perspective with related consumption and production data for the recipient economy. The bulk of studies lie between these two points. Most develop theoretical concepts based on bits of empirical data from several countries or concentrate on the analysis of empirical data from one country (or a few countries) to test hypotheses based on established theory.

The major issues which have been developed in the literature center around two aspects of food aid programs--the commodity impact and the local currency impact. Analysis of these topics has been subdivided further into controversies over consumption (improving minimum diet levels, allocation of marginal income, matching commodity aid with commodity demand, wages-in-kind, and shifts in consumption patterns),

[1] The review is by no means inclusive of all writings on the impact of P.L. 480. The author is aware of such additional studies as Adams on Colombia (3), Andersen (5) on pricing P.L. 480 commodities, Beringer and Ahmad (10) and Falcon (28) on Pakistan, F.A.O. on Japan (35) and Pakistan (36), Ginor (38) and Kahn (56) on Israel, Hillman on Brazil (45), Rath and Patvardhan (68) and Sen (72) on India plus numerous other papers dealing with the use of P.L. 480 commodities and related topics. Many of these and other additional writings have or will be cited for particular conceptual or empirical contributions at the appropriate places throughout this study.

prices (responsiveness of consumers and producers, desirable wholesale and retail price levels, and control of price fluctuations), production (competition with domestic producers, resource allocation, import substitution, and productivity of capital), and trade (maintenance of normal patterns, balance-of-payments benefits, and potential markets). Closely related topics which have been explored within this framework include changes in levels of investment, employment, income, inflation, tax revenue, and debt accumulation.

In general it has been concluded that P.L. 480 commodities do substitute for a portion of foreign aid to many developing countries without serious adverse effects. Estimates of the rate of substitution vary considerably between countries, or even within countries under alternative assumptions. It has also been concluded that requirements for the use of surplus commodities to promote economic development without adversely disrupting the recipient economy are: (a) the availability of idle resources which can be mobilized through the use of food aid, (b) the capability of matching commodity aid with derived consumer demand, and (c) the availability of supporting capital, domestic or foreign, to finance nonfood expenses and satisfy effective nonfood demand.

The Ezekiel study represented a systematic attempt to integrate the theoretical concepts of food aid with empirical data to predict the impact of P.L. 480 shipments on the recipient economy. The research team conducted the analysis with a limited amount of data and knowledge of the scope of P.L. 480 operations. As a consequence the study is generally limited to predictions based on one set of parameters for

consumption and production response. In classifying projects as isolated activities, the research team underestimated the total contribution which Type I, II, and III projects can make to the growth of the general economy by virtually ignoring the investment contribution of the projects to domestic production. This aspect was later mentioned when the program approach to uses of food aid was discussed. Given the limited time available and the major concentration on predicting the amount of food which could be utilized for specific types of projects, the Ezekiel study did not analyze project related variables such as the magnitudes of supporting capital needs, derived demand for nonfood commodities, tax revenue, investment, and employment.

The Srivastava study followed a similar framework by attempting to integrate theory and empirical data, but this study had the advantage of an additional decade of P.L. 480 operation. However, instead of estimating India's capacity to utilize food aid, the study concentrates on estimating expected values of variables such as derived income, food demand, employment, and balance-of-payment benefits to compare with actual values observed over the life of P.L. 480 contracting in India. While informative, this approach only begins to answer the crucial questions about P.L. 480 programming--those relating to the impact of stimulating rapid economic development in developing countries.[1]

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[1]The active discussion between Kusum Nair (Michigan State), Walter Falcon (Harvard), David Hopper (Rockefeller Foundation), and Willard Cochrane (Minnesota) of the second generation impacts of the Green Revolution and the awareness by the donors and recipients of the consequences (at the A.A.E.A. meetings in Columbia, Missouri on August 10, 1970) was an indication of the urgent need for answers to questions about the impact of accelerated economic development.

The remaining studies dealt with concepts more within a micro-economic framework. Emphasis was placed on analysis of producer and consumer response to conditions which prevailed during periods of food aid imports in an attempt to predict anticipated response under alternative conditions. In effect, these studies provide the parameters for a broader analysis of impact on the agricultural sector and general economy.

Objectives and Methodology of Present Study

The primary objective of this study is to describe and analyze the role of food aid in agricultural and economic development of recipient countries within a partial equilibrium framework. The secondary or supporting objectives are: (a) to develop a conceptual framework which explains the theoretical impact of food aid utilization on the recipient economy, (b) to examine the welfare aspect of raising income and nutritional levels of the very poor for humanitarian reasons through the use of commodity assistance, (c) to determine the impact of food aid on levels of income, food consumption, and nonfood expenditures of general consumers, (d) to determine the impact of commodity aid on agricultural prices and supply in the recipient country and the extent to which these responses might reduce the potential developmental effects of food aid, (e) to evaluate effects of food aid on national income, investment, and inflation and their relationship to development, (f) to analyze the extent to which food aid substitutes for alternative forms of foreign assistance in promoting economic development, (g) to examine the impact of commodity aid on commercial trade and balance of payments, (h) to explore methods through which food aid is incorporated

into the recipient economy to promote economic development without disrupting market conditions, and (i) to develop principles and policy guidelines for future food aid programming which will improve the efficiency of such assistance, make a major contribution to economic development, and minimize negative side effects.

This study attempts to increase our understanding of anticipated macroeconomic impacts of P.L. 480 shipments on recipient economies by concentrating on: (a) development of theoretical concepts of food aid, and (b) integration of empirical evidence from the several years of experience with P.L. 480 operations. The study draws on the theoretical framework of the Ezekiel study, broadens the analysis to include programming of food aid to alternative consumer groups, expands on the investment aspects of projects, estimates the magnitude of various economic variables under alternative assumptions, and analyzes their significance on agricultural and economic development.

INTERRELATIONSHIP OF INCOME LEVELS AND COMMODITY AID IN FINANCING DEVELOPMENT

Economic growth in developing countries is designed to increase the aggregate national income level of the economy. Although it need not, growth is commonly designed to also increase per capita income levels.[1] Economic growth has been achieved in some countries at the expense of the individual consumer, but more commonly growth is planned with maintenance of the consumer's current position in mind. On the basis of indices such as per capita production, income, investment and wealth, various comparisons are made regularly between nations as well as between sectors within nations. One major shortcoming of these aggregate indices is that they do not expose disproportionate distribution within a society. An extensive amount of literature and research has been devoted to the problem of distribution, but there is not "a single instance where statistical data in terms of aggregates and average have not been treated as providing adequate tests of the degree of achievement of economic development" (109, p. 14).

Conceptual Framework for Analysis of Development

Basically the essentials for economic development include an adequate supply of natural resources, a literate, healthy, and well-fed population, and an accumulating supply of capital. Although the absence of natural resources is not critical, as verified by Switzerland, it is usually

[1] The strongest objection to this approach comes from economists and politicians who advocate economic development even if it means sacrificing per capita income as has been the practice in several of the centrally controlled East European countries (109, p. 13).

severely restrictive at best. Without minimum health and education levels for the population, the adaptability and capabilities of the labor force are severely limited. Given the basic production relationships within an economy, some functional relationship exists, explicit or otherwise, between investment and output. In the development literature the functional relationship is reduced, for simplification, to the capital-output ratio. Inherent is the assumption that a change in output results only from a change in investment. Investment within a system is a function of savings which in turn is a function of income. Because savings is an increasing function of income, it is difficult to accumulate capital in low income countries where a majority of the income is spent for consumption. For the same reason, the greater the inequity of income distribution within a society, the higher the rate of aggregate savings and capital accumulation.

Although not the humanitarian approach to take, ignoring the very poor may be an economically expedient approach to development. When dealing with food aid, it may be wise development policy to use food to increase incomes of groups which already have relatively high incomes since less will be consumed and more will be converted into savings and investment. From a humanitarian standpoint, the groups which need the help most are the ones which lack the knowledge and incentives to help themselves. Those who advocate aggregate growth even if it results in disproportionate distribution rationalize by saying that the resources will eventually be redistributed to the poor.

With these relations as a basis, there are at least two primary reasons for increasing per capita income. In the low income nations,

consumers have high positive marginal utility for consumption, which implies that consumer welfare is improved as a consequence of increased incomes and resulting consumption. Secondly, because low income consumers do have a very high marginal propensity to consume, they in turn, have very low marginal propensities to save and contribute to investment, output, and aggregate income. Raising their income level may allow them to contribute to the development process.

If development is measured by any form of per capita statistics, a nation's population and associated growth rate have as great an impact on economic growth as any factor. World health and nutrition work has had a major impact on increasing child survival during early months of life and extending the life expectancy of adults. Both areas of improvement have had a significant effect on the short-run welfare of population, but may contribute very negatively to the long-run welfare if the supply of food an other commodities does not increase correspondingly.

Population control is a short cut to achieving growth as measured by per capita statistics. Most nations have been able to successfully achieve some level of absolute growth in aggregate income, but the population growth rate has exceeded the income growth rate, resulting in a decline in per capita income. If population growth had been at a minimal level, many developing countries with stagnant or declining levels of per capita income could have realized improved levels of welfare. Unfortunately, effective voluntary population control appears to depend upon high levels of education which in turn are normally associated with high income levels. Yet, as mentioned earlier,

population pressure probably is the single greatest barrier to achieving the necessary levels of income and associated education. Often referred to as the "vicious cycle of poverty," the relationship between poverty and population pressure has not been easy to break with any type of generalized plan or approach.

Possible alternatives for breaking the "vicious cycle" include freer international movement of capital under long-term agreements which are compatible with long-term development planning, elimination of trade restrictions in order to exploit comparative advantages, universal diffusion of technology and management skills, and persistent coordinated planning for employment of resources to attack basic problems within the developing nations.

Inflation can also be a significant element of growth. For the most part inflation tends to shift income from wage earners and fixed asset or fixed income recipients to holders of productive resources. Controlled inflation may actually stimulate a shift in income and corresponding increase in aggregate savings. On the other hand, inflation may hamper growth by contributing to inefficient investments which are made primarily to avoid the impact of future inflation. Speculative hedging may result in decreased investment for production purposes. One method of avoiding speculative hedging is through the use of fiscal policy by taxing away the marginal income and investing it in high priority projects. There is some evidence that the disincentives of such taxation schemes defeat the overall purpose. More effective government involvement may be accomplished by creating political and economic atmospheres which stimulate private investment

directly in the high priority areas. Government imports of foreign capital to supplement private investments is one method of creating a desirable atmosphere. The two greatest drawbacks are that low income countries are often also low wealth countries with low limits on their borrowing power, and the types of social overhead investments necessary to create a conducive atmosphere for private investment often have very low and/or very long-run payoff periods which are not consistent with standard loan terms. In addition the earnings from social overhead investments seldom accrue directly to the government, posing a revenue problem.

Exports from the developing nations have predominantly consisted of primary products such as agricultural commodities while imports have consisted of industrial products from the developed nations. If one perceives of development being universally possible in the developing nations, and agrees that they have a comparative advantage in agriculture, then one must conclude that the agricultural output of the developing nations will continue to provide their major source of foreign exchange earnings. Yet as data for the developed nations are examined, a question arises as to where the market for agricultural commodities will be. Projections for developed nations indicate they will be capable of supplying even greater surpluses of agricultural commodities in the future than at present. If production in the developing countries continues to lag behind demand, the terms of trade are certain to shift against agriculture and have detrimental effects on economic development. Price increases will reduce any potential for world exports and net contribution by the agricultural sector for foreign exchange earnings.

Even if a country does not have a comparative advantage in agriculture, forced industrialization is not the answer to all problems. Because of the rapid rate of technical change experienced in the industrial sector of developed nations, any initial deficit or subsequent lags in adoption of new technology which results in inferior or higher cost commodities will destroy any continued demand for products from developing nations in the competitive international market. Although countries like Korea and Taiwan have a distinct production advantage with low priced labor, it is quality and quality control which has restricted their development of dependable export markets.

No single plan for development is directly applicable to all nations or even all developing nations. Emphasis on the development effort depends upon the natural endowments of the particular country, adaptability of resources to various products, current stage or level of supply and effective consumer demand for various products, source and volume of potential investment funds, restrictions attached to importing investment funds, extent of scale economies in various industries, comparative advantages in world market, and the availability of entrepreneurial resources in particular industries (43, p. 29).

The achievement of rapid economic development has, in the experience of most nations, involved extensive planning and high levels of investment. As Ezekiel points out (34, p. 3), one form of investment to facilitate economic development involves the use of surplus agricultural commodities from a donor country to engage unemployed or underemployed workers of the recipient country in projects which will increase productivity such as building roads, wells, dams, irrigation canals, schools, warehouses,

processing plants, etc. In order to secure the services of the excess labor, it is necessary to pay wages or similar compensation.[1] The wages represent a direct increase in national income, but in addition they will be used by the workers in part or total to purchase food, clothing, housing, and other consumer goods, thus increasing consumer demand. In the absence of excess capacity, the increase in demand will drive up prices and cause an inflationary trend unless new facilities for production are developed or consumer goods can be imported to satisfy the increase in demand.

Economists are in general agreement that rapid inflationary price spirals must be avoided to establish and maintain rapid economic growth (54, pp. 573-574), but most developing nations face two limiting constraints which prevent them from satisfying the increase in demand independently. In many productive processes, there is an operational lag between investment and expansion of commodity output which, in the short run, prevents satisfying the expanded demand through expansion of domestic output. Secondly, the developing nations are faced with acute balance-of-payments problems which arise from their inability to produce sufficient export commodities to balance large imports. Given a supply deficit and the lack of foreign exchange to finance commercial imports, commodity aid can be an effective means of providing a large part of the goods for which increased employment generates effective demand. Inflation may thus be controlled.

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[1] The case of forced labor is ignored as an alternative in economies which are not centrally controlled.

Food aid has a unique potential for assistance since more than 50 to 60 percent of expenditure from wages are allocated for food in developing nations (54, p. 573). Because a large portion of low income budgets is allocated to food, food supplies must expand rapidly during development in order to prevent inflation. Since many of the developing countries have experienced difficulty in adequately expanding domestic agricultural production in the past, it is unlikely that they can expand production rapidly enough to meet additional demand from expanded development investments.

In addition to the initial impact of wages on demand, it is usually the case that some quantity of goods and services must be purchased locally to support development projects. These purchases represent increased income to domestic producers, either through expanded sales or higher prices. The additional income will, in turn, be used to purchase consumer goods for the producer or resources for future production. Part of the additional consumer purchases will represent demand for food and further expand the quantity of food aid which can be utilized without disrupting domestic prices. Purchases of additional resources, labor or commodities, represent still further income to other workers or producers. They, in turn, will result in additional purchases of food and other commodities. The respending of additional income received from the sale of domestic goods and services creates a multiplier effect which spreads through other sectors of the economy. The magnitude of the multiplier depends on leakage from the economy (i.e. imports, taxes and savings). Since food aid represents an import and leakage from the economy, the multiplier effect on national income

is affected by the proportion which food aid represents of the total project investment and subsequent derived demand.

The extent to which food aid can be used to 'finance' development without having a negative impact on domestic prices and production, depends upon the amount of derived food demand resulting from development investments. If food supply is increased more than is necessary to satisfy increased food demand, prices will be depressed. As represented in Figure 2, if development investments result in a horizontal demand shift from D to D', food aid could be supplied in an amount equal to Q_1Q_2 without a change in domestic prices and, in turn, domestic production. Alternatively, if food aid is supplied in an amount equal to Q_1Q_3 so that total supply is represented by S" instead of S', market equilibrium will be reached only if price falls to P_2 where the new demand and total supply (i.e. domestic supply plus food aid imports) intersect. The extent of the demand shift depends on the level of income of the individuals affected by the development investments and the income response of those individuals. This response is defined as the income elasticity of demand.[1]

Ohkawa (66, p. 49) defines the rate of increase in food demand (d) as the rate of population growth (p) plus the product of the income elasticity of demand for food (n) times the rate of growth per capita

[1]Income elasticity of demand is defined as the percent change in quantity demanded divided by the percent change in income. An alternative formulation which follows from the definition is the marginal propensity to consume divided by the average propensity to consume or the ratio of the change in quantity demanded to change in income divided by the ratio of quantity of demand to income.

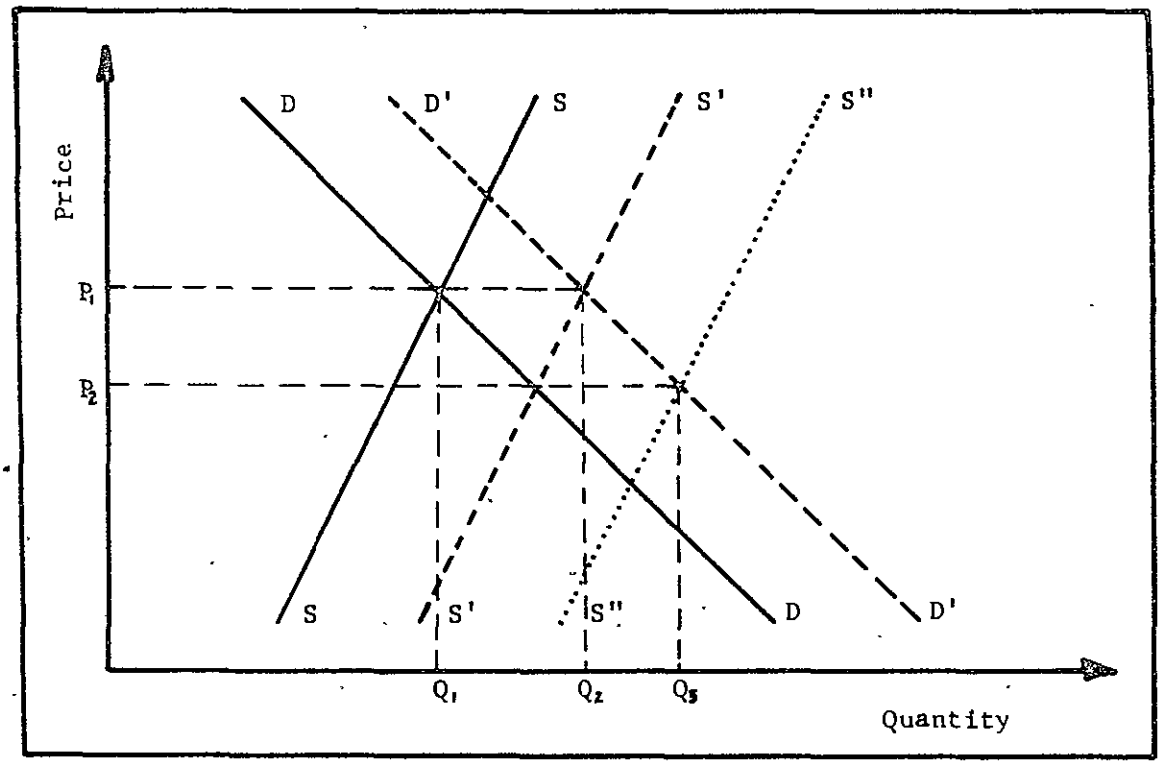

Figure 2. Aggregate food supply and demand equilibrium

income (g).[1] Heady (42, p. 645) and Johnston and Mellor (54, p. 572) agree that these are the three most important variables in the determination of food demand. If the population term is ignored temporarily as independent of investment activities, only the income term is left for consideration in estimating demand derived from development investments.

The importance of elasticity estimates is demonstrated in Figure 3, where alternative income elasticities are plotted on changes in income

[1] In the complete formulation, Ohkawa's equation was $d = p + gn + pgn$, but he dropped the last term because his empirical data indicated that it was less than one percent of the sum of the first two terms. This formulation assumes constant prices.

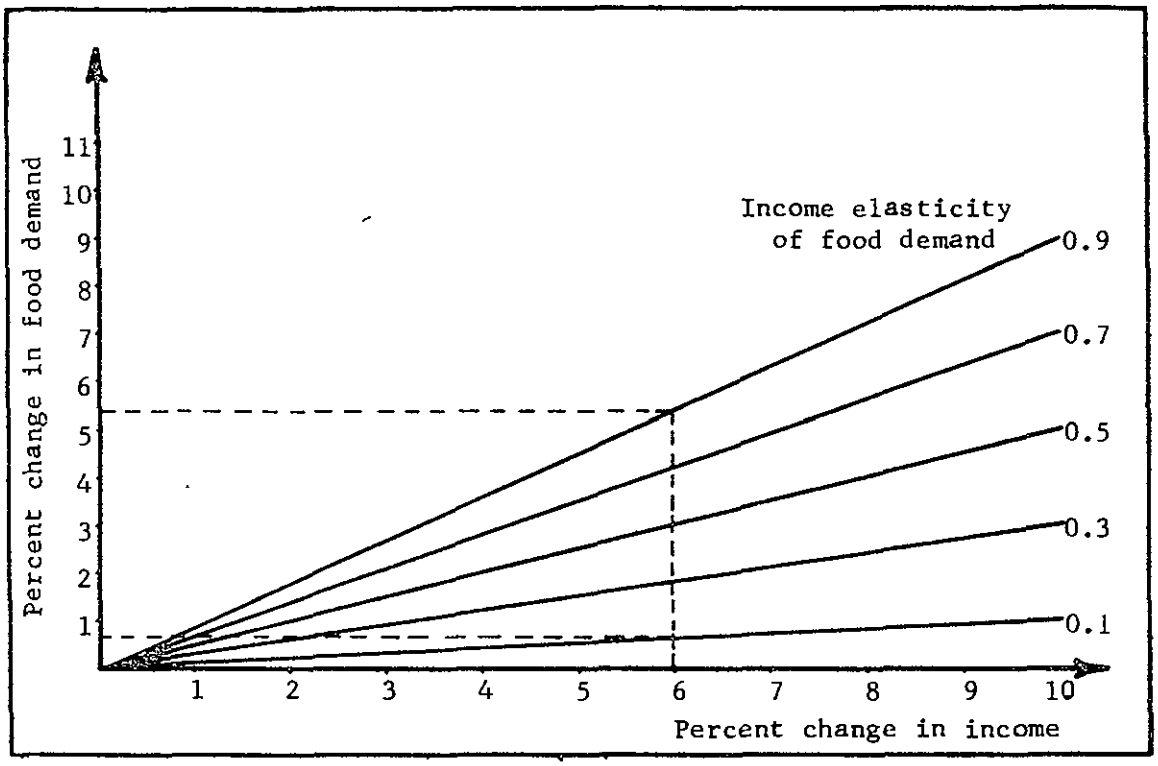

Figure 3. Food demand as related to income growth and income elasticity

levels. For the case of a 6 percent change in income, the range in rate of change in food demand is from 0.6 percent to 5.4 percent, depending whether the elasticity is 0.1 or 0.9. Similarly the absolute magnitude of the error when estimating quantities, will increase as the level of income increases.

Much conflict can be found in the literature concerning the magnitude of elasticity estimates. For example, Kuznets estimated the income elasticity of food demand in the U.S. from 1909-1955 at 0.90 (59, pp. 86-87 and 74, p. 14). In contrast, Burk estimated the income elasticity of demand in the U.S. from 1948-1957 at 0.24 (16, p. 25). From Figure 3

it is apparent that for a given change in income, estimates as divergent as these would result in considerably different estimates of changes in demand for food.

In order to estimate the total quantity of food aid which can be utilized with respect to a particular development project or program, the multiplier effect on income, and the derived demand for nonfood commodities, it is essential to understand the response of consumer groups which will be providing labor for the development projects.

Income Level as a Variant in Determining Demand for Food Aid

The earliest empirical 'law of consumption' was developed in the nineteenth centruy by Christian Lorenz Ernest Engel. Engel's Law, with respect to food consumption patterns, states that the proportion of income spent on food declines as income rises (30, p. 87). Thus, food expenditures represent a high proportion of budget allocations at low budget levels and decrease at higher income levels. At low income levels the consumer is surviving on a minimum of all commodities and a high percent of the budget is used for food. As the budget increases, food consumption expands rapidly at first and then begins to decline as an adequate nutritional level is approached. Food expenditures continue to increase, but at a decreasing rate as proteins are substituted for carbohydrates and the physical limit for individual consumption is approached.[1] Clark cites both the familiar generalization by Adam Smith

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[1]The Engel Curve and the food consumption function are closely related since they are both measures of the same basic relationship, and either can be derived directly from the other.

that "the desire for food is limited in every man by the narrow capacity of the human stomach" and his own international consumption study as proof of a definite asymptote when analyzing food consumption (18, p. 237).

Table 3. Percentage of 1968 food aid contracted--by recipient country per capita expenditure level[a]

Expenditure in dollars	Percentage of food aid	Cumulative percentage
50 - 74	18.64	18.64
75 - 99	50.61	69.25
100 - 149	10.10	79.35
150 - 199	8.64	87.99
200 - 299	2.95	90.99
300 - 399	2.80	93.74
400 - 499	0.44	94.18
Other	5.82	100.00

[a]Source: (32 and 80).

To analyze the impact of consumption habits at different income levels on the generation of effective demand for food and economic development, three income levels were selected as representative of the conditions under which food aid is programmed. The three levels of annual per capita income examined in detail are $75 as representative of low income levels, $250 representing medium income levels and $450 representing high income levels. While P.L. 480 contracts were authorized for thirty-seven countries during calendar year 1968, approximately 70 percent of the food was contracted by countries with per capita incomes of $50 to $100 per year. Another 21 percent was

contracted by countries over $300. In addition, a wide distribution of income underlies the average for any given country so that any or all of the above income levels might be observed for select groups within that country.

Low income recipients

The low income group is considered first. Countries receiving food aid which have annual per capita incomes close to $75 include the Congo ($87), Kenya ($100), Niger ($73), Nigeria ($68), Sierra Leone ($111), Somali ($62), Afghanistan ($52), India ($73), Pakistan ($108), Indonesia ($95), Korea ($140), and South Viet Nam ($108) (78, pp. 48-53). In addition, most other countries of the world have a segment of the population with similar income levels, so that the following discussion is applicable to low income strata within countries as well as to countries with similar averages.

The analysis is based on the premise that the recipient country finances part of a development project or program through the use of food aid. Consider an irrigation project which requires 100 units of investment to construct a reservoir and irrigation canals in order to increase agricultural production. Assume that the project inputs consist of 70 percent direct labor, 20 percent goods and services which can be purchased locally, and 10 percent materials and equipment which must be imported. How much of the cost can be financed with food aid, and what is the impact on the economy.[1]

[1] Johnston and Mellor (53, pp. 344-349) and Lewis (61, pp. 400-412) argue that there is a surplus of labor in the underdeveloped countries which can be engaged in productive activities if resources are available to compensate them for their labor. In neither case is it argued that marginal productivity of labor is zero, but only that productivity can be increased. Johnston and Mellor hypothesize that the remaining labor, after some is withdrawn for the development project, will simply work more intensely or longer hours so that production will not decline (53, pp. 346-347).

The labor needed for the project will increase employment and income directly by 70 units. Each worker will, in turn, increase his consumption of food and other consumer goods depending on his level of income elasticity of demand. Most of the consumer demand will be for domestically produced goods, but a small portion of demand will be for imported goods. Wages spent on domestic goods and services represent additional income and another round of spending which generates an income multiplier. The limit on the multiplier is a function of leakage from the economy in the form of savings, taxes, and imports. Through ten rounds of spending, an investment expenditure of 100 units generates 148.5 units of income, wholesale demand for food of 51.4 units, and demand for goods and services of 58.5 units.[1]

Under an assumption of four months for the expenditure lag, 94 percent of the increase in income and food demand would occur during the first year. Under an alternative assumption of three months for the income-expenditure lag, over 97.5 percent of the increase occurs during the first year. In either case the increase in income and demand for food occur very rapidly in the low income countries due to the high proportion of the budget which is allocated to food demand and consequently the rapid leakage from the economy when imported food aid is purchased to meet increased demands. Under these conditions about 51 units or half of the original investment could be financed in the first year through the use of food aid without affecting the domestic market prices.

In addition to the multiplier effect on income and food demand, the project would generate 12.5 to 13.0 units of savings and a similar

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[1] See Appendix C for calculations and tabular summary.

amount of tax revenue in the first 12 to 15 months. If the savings are channeled into investment and subject to a multiplier similar to the original investment, another 18 units of income and 6.2 units of demand for food would be generated. With the additional food demand generated from savings, total derived food demand in the low income case reaches 57.4 units in two years (six rounds). To balance supply with demand, 48.2 units of surplus food should be supplied in the first year and the remaining 9.2 units supplied in the second year.[1]

Government revenue generated through increases in income would be about 13 units. Assuming food was purchased by the recipient country under Title I rather than received as a donation, and used exclusively to meet the food demand generated from project wages, the 13 units falls far short of covering the full debt which the recipient country would contract in purchasing the surplus food. If, however, Schultz is correct in his estimate that return on P.L. 480 contracts only amounts to 10 to 15 cents on the dollar (71, p. 1024),[2] the revenue collected from

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[1]The method used to pay the workers (cash, coupons, wages-in-kind, etc.) for the portion of their income which will be spent on food is immaterial if the supply of food aid is matched with the increased demand resulting from the investment. Paying wages and then recapturing the revenue from food sales is simply a balancing transaction and does not generate revenue for the government any more than issuing food coupons or wages-in-kind.

[2]Schultz's estimate of return on food aid contracts is based on an estimate of long-run net payment on contracts by recipient countries. Where soft currency sales (not on long-term contract) are involved, the required deposit to a U.S. account may be considerably higher than the 10 to 15 percent figure, but through grants, exchange loss, etc. the net return which is realized by the U.S. is much lower than the value of the initial contract. Dollar sales and convertible currency sales should increase the net return considerably.

additional income generated from the investment would be sufficient to liquidate the debt. On this basis, to the extent that the recipient country could secure matching funds to support the food aid imports, the cost to the government would be at or near zero, and the only limiting factor on a developing country's use of food aid to finance development would be the quantity of excess labor which could be mobilized and the number of development projects which could be specified.

In addition to the cost consideration, a second factor could limit the use of food aid to finance development. For the investment under consideration, 10 units were required to import equipment and materials which were not available locally. Another 12 units of demand for imports were generated from the additional income. Together these represent over 20 percent of the initial investment. In cases where foreign exchange is critically limited, the generation of demand for imports would create additional pressure on the system. One alternative is to provide a broader group of commodities to the recipient country than just surplus food. Including the commodities demanded as imports in a P.L. 480 contract would not change the multiplier effect on the other variables since imports were already deducted when estimating the generated income and demand for food. Adding the 21.9 units of imports to the 57.6 units of food brings the total to 79.5 units of the original investment which could be financed with commodity aid without affecting the food market in the recipient country. The assistance package which would maximize use of commodity aid is, therefore, estimated

to consist of 57.6 percent food, 21.9 percent nonfood and 20.54 percent capital. Once again this conclusion rests on the assumption that availability of the commodity aid conforms in timing and composition with the demand which is generated.

Referring to a specific low income country situation, Indonesia contracted for $124.3 million of commodities under Title I of P.L. 480 during 1968 (80, p. 116). Subtracting the $40.9 million of cotton which was provided for in the contract leaves $83.4 million of food aid. Assuming that the statistics for Indonesia are approximately equal to estimates for the low income group as a whole, an investment of $145 million or an additional $61.6 million of capital will be needed to generate sufficient demand to balance the supply of surplus food. Alternatively, food aid could substitute for capital assistance up to 57.6 percent or $83.4 million of a $145 million investment program in Indonesia of the type set forth earlier in this section.

Based on an investment of $145 million for development, it is estimated that $214.6 million of income would be generated in two years (six rounds). An increase in income of $107.3 million per year (half of the two-year increase) represents slightly over 1 percent of the national income in 1967, $10,479 million (78, p. 51). At the average annual per capita income level of $95, 70 percent of the original investment of $145 million could provide employment for 1.07 million people. In addition to the direct project wages, labor is also marketed through and employed to market other goods and services. The maximum employment

which could be generated from the investment would result if the sale of all gods and services represented return to labor and no return to other resources. Combining the 58 units of demand for foods and services which the original investment is estimated to generate with the seven units which reinvestment of savings is estimated to generate, brings the total demand for foods and services to 65 units or $94.25 million dollars. At an annual wage rate of $95, the maximum employment which would be generated through sale of goods and services would be about 992 thousand man years. Therefore, the estimated increase in employment resulting from the development investment ranges from a minimum of 1.07 million to a maximum of 2.06 million man years.[1]

The impact on foreign trade and balance of payments can be viewed by looking at the increase in import demand. An investment of $145 million is estimated to generate a demand for imports of 31.67 million dollars ($17.17 million from consumer demand and $14.5 million directly for project support). The $40.9 million of cotton imported under P.L. 480 exceeds the estimated value of total demand for nonfood imports which would be generated by a $145 million development investment and suggests an apparent contradiction of P.L. 480.[2] If in fact Indonesia has contracted for more cotton than demand will be generated and, effective demand exists for

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[1] Both minimum and maximum estimates are based on a wage rate of $95. In addition the maximum depends on the proportion labor represents in the market price of goods and services.

[2] P.L. 480 requires that commodities contracted must be in addition to "normal" demand.

the sale of cotton so that the concessional imports are replacing 'normal' trade, Indonesia will derive foreign exchange benefits from the cotton portion of the contract. On the basis of the estimates, it appears that over $9 million of foreign exchange would be freed above the amount necessary to finance imports to support the original investment.

Alternatively, it is possible for Indonesia to satisfy the additionality clause if the total planned investment for development is larger than the minimum estimated and the $83.4 million of food aid contracted is not designed to meet the total increase in food demand. In this case domestic agriculture would be called upon to expand output considerably, commercial imports would have to increase, or more food aid would be needed to satisfy the additional demand and maintain current food prices.

Medium income recipients

The second group of developing countries considered have an annual per capita income level close to $250. These include Honduras ($209), Ecuador ($199), Peru ($241), Algeria ($207), Tunisia ($171), Ivory Coast ($203), Liberia ($154), Rhodesia ($217), Saudi Arabia ($288), Iran ($235), Jordan ($235), and Syria ($203) (78, pp. 48-53). Just as most countries have some of the very poor from the previous case, one would expect to find a segment of the population in low income countries as well as high income countries with per capita income of $250.

Again it is assumed that the recipient country finances part of a development project or program with food aid. To compare with the previous analysis where labor was supplied by low income consumers, a project will

be considered which uses 70 percent labor, 20 percent domestic goods and services, and 10 percent imports. Again, a large portion of wages will be respent for domestically produced goods and generate an income multiplier. Through one round of spending, an investment expenditure of 100 units generates 194.7 units of income, wholesale demand for food of 39.2 units, and demand for goods and services of 104.9 units.[1] Therefore, 84.5 percent of the total impact is generated in the first year and about 97.0 percent is generated before the end of the second year.

If the savings from the first year are assumed to be reinvested in the second year and subject to the multiplier of about 1.64,[2] another 24 units of income and 4.8 units of demand for food would be generated. Taking expenditure for wages, local supplies, and investment of savings all in to account, it is estimated that about 43 percent of development investments in the medium income countries could be financed with food aid without affecting domestic food prices, as compared to 57 to 58 percent in the low income countries.

Demand for imports would be 10 units for the original investment and 15.0 to 15.6 units derived from the total investment. With a broad definition of commodity aid, which includes nonfood commodities as well as food, the total contract could be raised to 69.6 units (44 units of food and 25.6 units of nonfood) or 69.6 percent of the original investment. In total, demand for commodity assistance has decreased from the low income case

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[1] See Appendix C for calculations and tabular summary.

[2] One hundred dollars invested in the first round generated 164.6 units of income by the end of the third round.

and the composition shifts from about 72 percent food and 28 percent nonfood to 63 percent food and 37 percent nonfood. An assistance package for the medium income countries which would maximize the use of commodity aid is, therefore, estimated to include 44.0 percent food, 25.6 percent nonfood, and 30.4 percent capital.

Focusing on a specific country, Tunisia contracted for $16.1 million of commodity aid in 1968 under Title I of P.L. 480 (80, p. 116). Since $2.4 million of the contract was for cotton and tobacco, and these commodities were not included as food items when determining consumer demand for food, only $13.7 million of the Tunisia contract represents additional food for which a balancing demand must be generated. Assuming that statistics for the medium income group are rough approximations for Tunisia, $13.7 million of food aid would require about $18.2 million of capital or nonfood commodity for a total investment of $31.9 million if sufficient demand is to be generated to balance the supply of surplus food. An investment of $31.9 million would generate consumer demand for imports amounting to $4.8 million plus the $3.2 million, 10 percent of investment for direct imports to support the investment, for a total of $8.0 million. Assuming that the $2.4 million of cotton and tobacco represented consumer import demand, the balance requiring foreign exchange or nonfood commodity assistance is $5.6 million.

Applying the six round multiplier of 1.9 to the $31.9 million investment, approximately $60.5 million of additional income would be generated in Tunisia over a two-year period. With a national income of

444.0 million Dinars[1] or $855 million in 1968 (52, p. 308), an additional $30.25 million of income per year (half of the two-year increase) represents an annual increase of about 3.5 percent. The minimum increase in employment derived from the investment would be 130,000 man years if the 70 percent paid directly for wages on the project represented total payment for labor at the current per capita level ($171 per year). However, a significant portion of income spent on goods and services also represents payment to labor. The maximum employment increase would be achieved if all of the $33.2 million of income spent on goods and services was paid to labor with no return to other factors of production. Consequently, the upper bound on annual employment resulting from the sale of goods and services would be 195,000 man years (at an annual wage rate of $171). The amount of employment generated by the investment is estimated between 130,000 and 325,000 man years, depending on the proportional return to labor and other resources which are marketed as goods and services.

High income recipients

The third group of countries considered have annual per capita income levels around $450. This group includes Mexico ($478), Costa Rica ($359), Panama ($477), Argentina ($519), Chile ($465), Uruguay ($526), and Barbados ($410) (78, pp. 48-53). With stratification of income which occurs within countries, many of the other countries would be expected to have segments of the population with incomes at this level as well.

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[1]The official exchange rate was 0.52 Dinars per dollar in 1968 (52, p. 306).

For consistency with the two previous sections, an investment which requires 70 percent labor, 20 percent local goods and services, and 10 percent imports will be analyzed. In the high income case, 100 units of investment would generate 221.4 units of income, 32.0 units of wholesale demand for food, and 131.9 units of demand for goods and services.[1] In contrast to the lower income levels, demand for food represents a smaller portion of the budget and consequently a slower leak from the economy if food demand is balanced with food aid. The resulting impact spreads the respending process over more rounds so that only 79.5 percent of the impact is generated in the first year (3 rounds), 16.8 percent in the second year, and 3.7 percent in the third year. The combination of low marginal propensity to consume food and the longer period over which the multiplier effect is applicable implies that not only will less food aid be needed in the high income countries, but it will have to be spread over two or three years in order to balance the availability of food aid with the derived demand.

Closely related to the demand for food and leakage from the economy is the magnitude of the income multiplier. For the high income case the multiplier is estimated at 2.2 over 10 rounds as compared with 1.49 and 1.95 with the low and medium income cases. Likewise the magnitude of derived savings and tax revenue are estimated to rise to about 20 percent of initial investment as compared with 13.4 and 17.5 percent previously. The increase in savings represents a potential for increased private investment and expanded production. Likewise, the tax revenue represents a

[1] See Appendix C for calculations and tabular summary.

source of increased public investment or revenue to retire the debt for food aid contracts.

At the same time estimates of derived demand for imports increase to 17.7 percent of the original investment. Adding the 10 percent for direct support of the investment pushes the derived demand for imports well over a quarter of the value of the investment plan. Unless significant steps can be taken to develop import substitutes or export earnings, a country experiencing a shortage of foreign exchange will find the balance-of-trade problem more critical.

Derived demand for food is estimated to reach 25.3 percent of the investment in one year, 30.7 percent by the end of two years, and 32.0 percent at the end of three years. Assuming that savings from each round are reinvested, the derived demand for food would increase to 36.5 units or 36.5 percent of the original investment over a three year span. Distribution of the demand would be 25.3, 9.1, and 2.1 units respectively for the three years.

For the high income group the aggregate composition of the financing which is estimated to balance demand with available commodities and utilize the maximum amount of commodity aid would be 36.5 percent food aid, 27.7 percent nonfood aid equivalent to the import demand, and 35.8 percent in capital.[1]

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[1]Presumably the 35.8 percent above food and import demand could also be provided as commodity aid consisting of goods which are similar to those produced domestically, but this would reduce the multiplier effect through increased leakage.

Relating to a specific country, Uruguary contracted for $20.6 million of Title I P.L. 480 assistance in 1968 (80, p. 117) of which $18.0 million was food and $2.6 million was nonfood commodities. In order to utilize the $18.0 million dollars of food for development investments without releasing the food aid on the local market system, a total investment of $49.3 million was necessary on the basis of the derived demand estimated previously.

A total investment of $49.3 million, assuming statistics for Uruguay are approximately equal to those estimated for the high income group, would generate approximately $109 million dollars of additional income. Given a national income of 141.13 billion Pesos in 1967 (52, p. 334) or $705.65 million,[1] an increase of $109 million over three years represents an annual income of about 5.1 percent. If 70 percent of the initial investment was for labor at a wage rate equal to the present annual per capita income level, employment is estimated to rise by 65,700 man years. Depending on the labor portion of goods and services, a maximum increase in employment derived indirectly could reach 329,000,[2] so that the range on derived employment is estimated at 65,700 to 394,700 man years over a three-year period. The development

[1]The official exchange rate for 1967 was 200 Pesos per dollar (52, p. 332).

[2]Based on 131.9 units of demand for goods and services from the initial investment plus 26.9 additional units from reinvested savings and a per capita income of $526.

investments are estimated to generate $9.9 million of government revenue. In contrast to the low income case where government revenue reached only about 23 percent of the value of the food aid, revenue in the high income case is estimated to reach approximately 55 percent of the food contract. This fact alone does not suggest that the return on the food contract to high income countries would be expected to be two and a half times as high as on contracts with low income countries. It must be kept in mind that the $9.9 million of government revenue must, comparatively, service an additional 63.5 percent of the investment as compared with only an additional 42.4 percent in the low income case.

Demand for imports as a consequence of the investment would equal $13.65 million. Assuming that the $2.6 million of nonfood commodity aid contracted under P.L. 480 would satisfy a similar amount of import demand, a balance of $11.05 million of foreign exchange or nonfood commodity assistance would be needed. Since Uruguay experienced a $22.2 million trade surplus in 1968, commercial imports could be used to satisfy the additional demand for inputs.

General relationships between income level and food aid

Analysis of the multiplier impact of developmental investments on income, adapted to the developing countries through the use of empirical estimates for structural parameters, provides a theoretical framework for estimating corresponding effects on other economic variables such as demand for food, other goods and services, and imports. Of particular interest in this study is the derived demand for food which will result

from a given investment. In countries where food supply is already lagging behind demand, investment activities which expand consumer income and demand for food are certain to put inflationary pressures on food prices. As a counteraction, the importation of P.L. 480 commodities which are compatible with the derived demand could offset the increase in demand by augmenting domestic supply and commercial imports.

Assuming that the objective of the recipient country is to increase aggregate income through increased investments while simultaneously increasing domestic production of food, maximum use of food aid to finance investments is specified by the resulting derived demand for the food commodities supplied as aid-in-kind. Using empirical estimates for low ($75), medium ($250), and high ($450) income countries, derived demand for food was calculated at 57.6 percent of the initial investment at the low income level, 44.0 percent at the medium income level, and 36.5 percent at the high income level. On this basis the maximum amount of food aid which would be used to finance development investments in the high income countries would be around one third of the total investment while in low income countries the proportion could exceed 55 percent with depressing domestic food prices.

Table 4. Composition of foreign assistance to maximize use of commodity aid in development investments

Income group	Derived demand		Supporting capital
	Food	Imports	
Low	57.6%	21.9%	20.5%
Medium	44.0%	25.6%	30.4%
High	36.5%	27.7%	35.8%

While the variation in maximum proportion of food aid which could be used exceeds 20 percent, the difference under a broader definition of commodity aid is smaller. If nonfood items for which an import demand is derived are included in the commodity aid package, derived demand resulting from development investments reaches 79.5 percent in the low income case and 64.2 percent in the high income case. For the labor intensive projects analyzed, the foreign assistance agreement which would most nearly match resource supply and demand while making maximum use of commodity aid would include 60 percent food, 20 percent nonfood commodities, and 20 percent supporting capital for the low income countries. An agreement for the medium income group would include roughly 45 percent food, 25 percent nonfood commodities, and 30 percent supporting capital. For the high income group, the agreement would include about 35 percent food, 30 percent nonfood commodities, and 35 percent supporting capital.

Project Composition, Savings, and Taxation as Variants in Demand for Food Aid

The analysis of the previous section maintained the assumption of labor intensive projects (70 percent labor) and constant rates of taxation, savings, and import demands in order to isolate the effects of per capita income on demand for food aid. By holding income constant and varying the other coefficients one at a time, their impact can also be isolated.

Alternative resource requirement for project investments

As an alternative to the labor intensive projects which required inputs in a 70:20:10 ratio, the impact of a less labor intensive project is analyzed. Consider a project which requires 50 percent of the input as labor, 35 percent as domestic goods and services, and 15 percent as imports. The shift from labor inputs to increased use of domestic goods and services and foreign imports lowers the income multiplier because of the increased leakage through imports.[1] As the result of generating less income, all of the other variables except imports would decrease slightly (1-3%). The derived demand for imports would decrease proportionately with the other variables, but the additional direct demand for imports to finance the investment would result in a net gain in imports.

In conclusion, the composition of a development project with respect to labor and other domestic inputs appears to have little effect on total impact of the project under the parameter assumptions of the two cases. Obviously, a project with a higher initial input of labor would have a greater immediate effect on employment then one which had a high input of goods and services. If it can safely be assumed that the commodity which is in surplus is labor and not a stockpile of goods, then projects with high labor requirements would still be preferred, not because of a long-run difference but because of the immediate problem of designing projects around available resources.

The portion of imports required to support the initial investment does affect the impact of the investment because of the leakage from the system. On a percentage basis, a change in import requirements of 5 percent reduced the income multiplier by 8 to 12 percent depending on the income group and the corresponding demand for food imports. Since

derived imports, savings, tax revenue, food demand, and other goods and service demand are all functions of aggregate income, an increase in imports which reduces the potential income also reduces each of the other variables by a proportionate amount. For each of the three income groups, the reduction in derived demand for imports is less than the 5 percent increase in imports for the project so that a net increase in imports and demand for foreign exchange would result from projects with higher requirements for imported inputs.

Alternative parameter estimates for savings and taxation

For the purpose of analyzing the impact of various parameter estimates on the demand for food aid and related economic variables, consider the possibility that the marginal savings and taxation rates used in the previous estimates were too high. To standardize comparisons with earlier calculations, a project requiring 70 percent of the resource input as labor, 20 percent as domestic goods and services, and 10 percent as imports is used at the basic analytical unit, but the savings and taxation rates are lowered.

A lower savings rate implies less leakage from the economy and consequently a higher income multiplier. However, if it is assumed as in the earlier analysis that savings from the first year are reinvested the second year, a reduction in the savings rate would result in less income being generated as a second round impact. Expanded throughout an entire multiplier series, the two effects would balance each other. Consequently the magnitude of the savings coefficient would only by significant if

the savings were not reinvested. In that case the lower the saving rate, the higher the income multiplier and corresponding derived demand for food.

The same would be true for tax revenue. The rate of taxation has little impact on the aggregate multiplier as long as the government reinvests the tax revenue. If on the other hand the government uses the revenue for external debt servicing or other uses which remove it from the economy, a higher tax rate would lower the income multiplier by increasing the leakage.

In conclusion, if the estimates for savings and taxation are too high, the estimates for the income multipliers and other variables would be slightly underestimated in the high income case but not significantly different in the low or medium income case. The real impact of the savings and tax rate is not in the nominal rate, but the extent to which savings and tax revenue are reinvested in the economy.

A note on marginal import rates

In the calculation of the direct impact of an investment on income, a reduction of the import rate would produce the same effect as reducing the savings or tax rate. Since import demand for consumption excludes future reinvestment, the direct gain would not be offset by loss of future investment as with savings or taxes. The lower marginal import rate would decrease derived demand for imports and foreign exchange. Imports will be less affected in the high income group than the lower ones because the lower import rate produces a greater income effect at each income level and imports are a constant percent of aggregate income.

Consequently a policy to lower marginal import rates would have a greater impact on foreign exchange savings in the low income group than on either of the higher income groups.

INFLUENCE OF DEMAND DIFFERENTIATION ON THE IMPACT OF P.L. 480 SHIPMENTS

Increased investments, as discussed in the previous section, represent one specific technique from a broad class of methods or procedures which can be employed to expand demand. In general, expanding demand requires that new markets be developed. In the particular case analyzed in the previous section, the 'new' market was created by increasing income and raising economic demand.[1] A second case involves price discrimination to increase total demand and consumption. The theoretical basis for expanding the demand for food was set forth by Waugh, Burtis, and Wolf in their 1936 article analyzing controlled distribution of a crop among independent markets. They pointed out that "in most cases, maximum net income could be obtained from a distribution aimed definitely at maintaining higher net prices in some markets than in others" (110, p. 6). In order to increase revenue by lowering price in a second market, it is necessary that the two markets are at least partially independent.[2]

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[1] Even where labor for a development project is supplied by workers who were previously partially employed, the additional income, employment, and consumption represents a total gain if the vacancies are filled by other unemployed or underemployed workers (14, pp. 920-922).

[2] The only way revenue could increase if the two markets are direct substitutes is if price elasticity of demand is greater than unity, implying a price decline in the single market situation would have increased total revenue.

Several methods of market differentiation have been used in the U.S. which could be applied to food aid distribution in other countries. Supplying the commodities in a slightly different form than normal marketings would be one of the easiest to administer (i.e., supplying U.S. commodities which are similar but not perfect substitutes for domestic products). Product differentiation allows for a lower price to be charged without experiencing a major decline in the primary market demand. Consumer differentiation can be achieved by issuing special purchasing passes which provide for lower prices, increased rations, or shopping privileges at special markets (i.e., food stamp or coupon distribution to low income consumers). Geographic or economic isolation provides for still another possible means of market differentiation.

In any case, if total demand could be expanded by differentiating the market, food aid could be supplied to a recipient economy through one or more of the differentiating techniques without, or at least with a minimum, negative impact on prices. As Westmore et al., pointed out in their study analyzing the expansion of demand for farm food products, demand expansion seemed to be the logical solution to the simultaneous problem of surplus commodities and underconsumption (111, p. 3). Although applying the concepts of demand expansion to distribution of food aid is a slightly different framework, the objectives are the same as long as producer welfare and consumer welfare are a joint concern. Fisher suggests in his discussion of the impact of open-market sales and donations (31, pp. 863-867) that the negative impact on prices is reduced when food aid is distributed without entering the market in competition

with domestic supply. Waugh, Burtis, and Wolf concluded that "if the system of differentiated prices were such that poorer consumers could buy a commodity at lower prices than could richer consumers it appears quite possible that there might be a net gain in the sum total of satisfactions obtained by consumers from the consumption of the commodity" (110, pp. 34-35). Distribution of P.L. 480 commodities at differentiated prices may be one such means of improving consumer welfare while minimizing negative impacts on producers.

The government controlled distribution system for P.L. 480 imports in India, the "fair price shop" system, has established a condition of price discrimination in the cereal market based on product differentiation. Pricing cereal at the fair price shops below the open-market price has drawn some, but not all, consumers from the open market to the fair price market. Independently, this movement from one market to the other is not evidence of an increase in aggregate demand. In fact, it is evidence that demand in the open market has decreased (shifted to the left) since aggregate demand indicates various price-quantity relationships, given a specified number of consumers. Removing part of the consumers from the open market causes aggregate demand in that market to shift toward the origin because aggregation is over a smaller number of consumers, not because of any change in individual demand by the consumers remaining in the open market. The response of consumers who shift from the open market to the fair price market determines the magnitude of the net shift (increase) in demand.

Every unit of cereal purchased from the fair price shop instead of the open market represents an increase in real income for consumers equal

to the price difference between the open market and the fair price market. Consumers allocate the additional income according to marginal preference so that from zero to 100 percent of the increase will be spent for food. At one limit, none of the increase in real income would be allocated for food purchases and fair price sales (in quantity) equal the reduction in quantity sold in the open market. Under these conditions open market demand would shift to the left by an amount equal to the distribution of food aid, and the total demand would remain unchanged. However, due to the shift in supply resulting from the availability of food aid and an unchanged demand, trading would occur along the demand curve down to the intersection with the new supply curve where the quantity of food demanded would be greater than before P.L. 480 imports due to the lower prices.

At the other limit, all of the additional real income would be allocated for food purchases in the fair price shops (implying a marginal propensity to consume food of 1.0) so that fair price purchases would be larger than the reduction in open-market sales by the ratio of open-market price to fair price. Under these conditions open-market demand would shift to the left, but when the demand from the fair price shops is added to the open-market demand, the net shift would be to the right. Except where the fair price is zero, the demand shift will be less than the supply shift and a price adjustment would result in an increase in quantity demanded also.

Consequently, when P.L. 480 commodities are distributed at a concessional price, the distribution produces a real income effect for consumers and demand shifts accordingly to marginal allocation of income.

For this reason, as indicated earlier in Figure 2, it is not necessary for prices to be depressed as severely for a new equilibrium to be reached as previous writers have indicated. In fact, if P.L. 480 commodities are distributed in such a manner that aggregate demand shifts by an amount exactly equal to the P.L. 480 imports, the price need not be depressed at all for a new equilibrium to exist.

In an earlier study of the impact of commodity aid, an econometric model was developed to measure the impact of P.L. 480 imports on the Indian economy (63, pp. 131-146). An implicit assumption underlying the model as that demand for P.L. 480 imports was homogeneous with demand for domestic commodities and that P.L. 480 commodities entered the market in the same way as domestic production. Quite on the contrary P.L. 480 commodities enter the market primarily through the fair price shops at fixed price, set below the open market price for domestic cereals. There is strong evidence, as will be discussed later in this chapter, that the fair price system provides for one means of market differentiation, and in turn, expanded demand as a result of the real income effect of the lower prices at the fair price shops. If the theoretical arguments presented by Fisher (31, pp. 863-867) and Waugh, Burtis, and Wolf (110, pp. 34-35) can be supported empirically, it must be concluded that previous analytical work which did not consider the real income effect on demand, but only a shift in supply, overestimated the negative impact of P.L. 480 imports on domestic prices and domestic production. For the same reason, the contribution of P.L. 480 imports to welfare in the recipient country has been underestimated.

A Model for Analyzing Market Differentiation

In the following sections a model is developed to analyze the impact of P.L. 480 imports on a recipient economy when market differentiation is used to distribute the commodities to consumers. The model is applied to Indian data and the results compared with previous estimates of P.L. 480 impacts on prices and domestic production.

A theoretical model

To incorporate the concept of market differentiation into the analytical framework developed by Mann (63, pp. 131-146), it is necessary to add an additional equation to the system so that provision is made for cereal purchases on both the open market and through the fair price shops at concessional prices. Incorporating a second "demand" equation and modifying various other equations in the basic Mann model to reflect stronger causal relationships and improve their reliability, a model is specified by defining several *a priori* functional relationships which are presumed to exist as indicated on the basis of theoretical considerations. The model includes (1) a supply equation, (2) an open-market demand equation, (3) a concessional market distribution equation, (4) an income equation, (5) a commercial import equation, (6) a withdrawal from stocks equation, and (7) an excess demand equation. The reduced form of the systems of seven equations will provide estimates for the quantitative impact of P.L. 480 shipments of cereal which are distributed through a concessional market arrangement.

The quantity of cereal produced during the current year depends on production decisions, weather conditions, and available technology during

the previous growing season. In developing economies, producers' primary source of information with respect to market price is prices received for the previous crop. Consequently, if the quantity available for consumption in period t is a function of production during period t-1, and expected price is based on the price in the previous period, supply in period t is a function of price in t-2.

The theoretical supply function is specified as

$$Q_t^s = f_1(P_{t-2}^c, R_{t-1}, T_{t-1}),$$

where

Q_t^s is per capita quantity of cereal available from domestic production for consumption in period t,

P_{t-2}^c is an index of wholesale cereal price (deflated by a consumer price index for all commodities) in the period prior to production,

R_{t-1} is a rainfall index as a proxy for weather conditions during the producing season, and

T_{t-1} is cereal yield as a proxy for other factors affecting production such as adoption of technology.

Formulating the open-market demand equation from microeconomic theory, quantity of cereal demanded is assumed to be a function of cereal price, price of substitute commodities (other food) and income level. The demand equation is specified as

$$Q_t^d = f_2(P_t^c, P_t^r, Y_t),$$

where

Q_t^d is per capita quantity of cereal demanded in the open market for consumption in period t,

P_t^c is wholesale cereal price (deflated by a consumer price index) in period t,[1]

P_t^r is price of noncereal foods (deflated by a consumer price index) in period t, and

Y_t is per capita consumer income (deflated by a consumer price index) in period t.

Distribution of P.L. 480 imports through the fair price shops in India is a function of economic variables at the minimum level and a physical restraint at the upper level because of the fixed price offering. At least part of the consumers consider imported cereal an inferior commodity and will continue to purchase cereals on the open market even when there is a price differential between the open market and the concessional market. However, as the two prices diverge, more and more consumers are willing to substitute imported cereal for domestic cereal. Consequently, the demand for cereals through the fair price shops is a function of price at the concessional market, price of cereal in the open market as a substitute, and income level of consumers. At the upper limit, price adjustment can not serve as a balancing mechanism to equate demand with a limited supply because the price is fixed by the government and has been held relatively constant. Consequently, the upper limit on distribution through the fair price shops is the quantity

[1] Strictly speaking the supply equation is formulated in terms of wholesale prices and the demand equation in terms of retail prices, but with an assumption about stable marketing margins, a demand function can be derived in terms of wholesale prices.

which the government chooses to release for distribution. Since the primary source of commodities for distribution through the fair price shops has been P.L. 480 imports, quantity of imports are entered in the concessional distribution equation as a proxy for the maximum quantity available for distribution. The concessional distribution equation is specified as

$$Q_t^c = f_3(P_t^p, P_t^c, Y_t, M_t^p),$$

where

Q_t^c is per capita quantity of cereal distributed through the concessional market in period t,

P_t^p is predetermined cereal price charged in the concessional market (deflated by a consumer price index) in period t,

M_t^p is per capita quantity of concessional imports of cereal under P.L. 480 in period t, and the other variables are defined as above.

In developing countries, the economy is usually predominately agricultural so that production in the agricultural sector has a significant impact on aggregate income in the economy. The other dominate sector in India is the industrial sector. The third major source of income in India has resulted from government expenditure, particularly through the involvement of the government in financing development investments. The income equation is specified as

$$Y_t = f_4(Q_t^s, Q_t^i, G_t)$$

where

Q_t^i is the value of per capita industrial output (deflated by a consumer price index),

G_t is per capita government expenditure (deflated by a consumer price index) in period t, and all other variables are defined as above.

Commercial importing of cereal is handled through the government of India and is used as a policy instrument to relieve inflationary pressure on food prices when domestic food shortages occur. As such, the government imports food to satisfy consumer demand, and commercial imports of cereal are effectively a function of the same factors that determine the demand for cereal on the open market. The commercial import equation is specified as

$$M_t^o = f_5(P_t^c, P_t^r, Y_t),$$

where

M_t^o is per capita quantity of commercial imports of cereal in period t, and the other variables are defined as above.

Withdrawals from government stock provides a residual source of cereals to balance other government programs. As the government increases internal procurement of domestic production to support prices, the need for withdrawals to control inflation of cereal prices and to satisfy other government demand (such as feeding military personnel and inhabitants of public institutions) decreases. In the opposite direction, as the government increases the availability of cereal for distribution through the fair price shops, withdrawals from government stock must increase if other sources of supply remain constant. Finally, commercial

and concessional imports are alternative sources for satisfying government demand for various programs, so that withdrawals from government stock are a function of the level of import activities. The withdrawal equation is defined as

$$W_t = f_6(Q_t^c, M_t^o, M_t^p, C_t^p),$$

where

W_t is per capita net withdrawals of cereal from government stocks in period t,

C_t^p is per capita internal procurement of cereal by the government in period t, and the other variables are as defined above.

The last equation is an excess demand or market identity equation to close the system by forcing excess demand for cereal to equal zero and is specified as

$$Q_t^d + Q_t^c - Q_t^s - M_t^p - M_t^o - W_t = 0,$$

where the variables are all defined as above.

The model consists of seven equations and sixteen variables. Since the purpose of this model is to evaluate the economic impact of P.L. 480 imports on prices and domestic supply of cereal, certain variables are treated as given or predetermined outside the system. The predetermined or exogenous variables include T_{t-1}, R_{t-1}, P_t^r, P_t^p, C_t^p, M_t^p, G_t, P_{t-2}^c, and Q_t^i. The values for these variables are given at a particular point in time and are not subject to determination by the econometric model. The remaining seven variables, which include Q_t^s, Q_t^d, Q_t^c, P_t^c, Y_t, M_t^o, and W_t,

are the object of determination within the constraints of the model. These seven variables make up the set of jointly determined or endogenous variables for which estimates are desired.

The seven structural equations provide the joint interactions of the variables in the system. To provide for independent examination and analysis of the jointly determined variables, the structural form is solved to obtain the reduced form where each dependent variable is uniquely defined as a function of the independent variables and the constraints of the system in the derived reduced form.

Applying Johnston's procedure for determining identification,[1] all seven equations are overidentified (55, pp. 250-251). Under conditions of overidentification, the two stage least squares method of regression will provide consistent and unbiased estimates of coefficients of the structural form (55, pp. 262-263). With estimates of the coefficients for the endogenous variables (β's) and the predetermined variables (γ's), the reduced form coefficients can be derived as

$$\hat{\Pi} = -\hat{\beta}^{-1}\hat{\Gamma},$$

where

$\hat{\Pi}$ is the matrix of reduced form coefficients,

$\hat{\beta}$ is the matrix of endogenous variable coefficients, and

$\hat{\Gamma}$ is the matrix of predetermined variable coefficients.

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[1]The number of predetermined variables not in the equation (K**) must be equal or greater than the number of endogenous variables minus one included in the equation ($G^{\Delta-1}$) in order to be identified.

An empirical model

An empirical model was estimated using secondary data from India covering the years 1956 to 1967 inclusively. The data indices for consumer prices, cereal price, noncereal food price, and consumer price were taken from Brief on Indian Agriculture 1969 (91, Table 20). Data on midyear population, cereal production,[1] and national income were taken from Economic Survey 1969-70 (49, pp. 61, 72). The data on net imports and P.L. 480 imports (wheat and rice) were taken from Brief on Indian Agriculture 1970 (92, Tables 15-17). Data on cereal withdrawals from government stocks, cereal demand, distribution of cereal through the fair price shops, internal procurement of cereal, fair price for wheat, and industrial output were taken from Bulletin on Food Statistics (25, pp. 48, 196, 250, 260). Rainfall and yield data was taken from the Economic and Political Weekly (22, p. A-166). Government expenditure data were taken from International Financial Statistics (52, p. 164). Units of measure used in model were: kilograms for Q_t^s, Q_t^d, Q_t^c, M_t^o, W_t, C_t^p, and M_t^p; rupees for Y_t and G_t; kilograms per hectare for T_{t-1}; and indices for P_t^c, R_{t-1}, P_t^r, P_t^c, P_{t-2}^c, and Q_t^i which do not have unit values.

Two-stage least squares was used to estimate the coefficients of the structural equations except the supply equation where the presence of only one endogenous variable allowed the use of ordinary least-square to estimate the associated coefficients.

[1] Production was adjusted downward by 12.5 percent to allow for feed, seed, and waste in calculating the amount available for consumption (49, p. 72).

Writing each estimated equation with the normalized variable on the left-hand side and all other variables on the right-hand side provides an overview of the estimated structural model. The supply equation,

$$Q_t^s = -13.89343 + 0.09118\ T_{t-1} + 0.56808\ R_{t-1} + 0.24424\ P_{t-2}^c,$$

has positive signs on all three independent variables indicating that supply of cereal (Q_t^s) reacts positively to increases in the weather variables (R_{t-1}), the proxy for technology (T_{t-1}), and price (P_{t-2}^c). The estimated price elasticity of supply at the means is 0.156 which compares with National Council of Applied Economics Research estimates of 0.22 for rice, 0.16 for wheat, and 0.16 for barley (51, p. 168). The multiple R^2 for the supply equation is 0.82 and the regression is significant at the 99 percent level. The open-market demand equation,

$$Q_t^d = -10.54661 - 0.553321\ P_t^c + 0.72847\ Y_t + 0.047698\ P_t^r,$$

has signs on all coefficients which agree with economic theory indicating that demand for cereal (Q_t^d) is negatively correlated with price of cereal (P_t^c) and positively correlated with the price of other food (P_t^r) and income (Y_t).[1] The estimated price elasticity of demand is -0.39 which is slightly higher than the N.C.A.E.R. estimate of -0.34, but well between their estimate of -0.19 for rice and -0.73 for wheat (51,

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[1] An alternative formulation of the open-market demand equation was considered which included the price charged at the fair price shops, but the regression coefficient was insignificant even at the 50 percent level and did not improve the multiple R^2. Consequently, the concessional price was excluded from the final equation.

p. 80). The multiple R^2 for the open-market demand equation is 0.89 and the regression is significant at the 99 percent level. The concessional market distribution equation,

$$Q_t^c = 60.91986 + 0.289881\ P_t^c - 0.251656\ Y_t - 0.22217\ P_t^p + 0.89376\ M_t^p,$$

indicates that purchases at the concessional market (Q_t^c) are positively correlated with price of cereal in the open market (P_t^c) and negatively correlated with income level (Y_t) and price of cereal at the fair price shops (P_t^p).[1] The relatively large coefficient on M_t^p supports the argument that distribution through the concessional market is highly correlated with imports under P.L. 480 contracts and the associated decision to make those commodities available for distribution through the fair price shops. The multiple R^2 is 0.90 and the regression is significant at the 99 percent level. The income equation,

$$Y_t = 118.91530 + 0.80042\ Q_t^s + 0.28386\ Q_t^i - 0.00092\ G_t,$$

indicates that income (Y_t) is positively correlated with agricultural (Q_t^s) and industrial supply (Q_t^i) but negatively correlated with government expenditure (G_t). In examining the correlation matrix for the variables in the model, it was noted that government expenditure was positively

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[1] An alternative formulation of the concessional distribution equation included price of other food, but the regression coefficient was insignificant even at the 50 percent level and caused the ratio of regression sum of squares to residual sum of squares to decrease.

Table 5. Correlation coefficients for government expenditure and income

	Government expenditure	Deflated government expenditure
Aggregate income	.9625	.7633
Per capita income	.9515	.7483
Deflated per capita income	-.5568	-.2228

correlated with both aggregate income and per capita income, but negatively correlated with deflated or real income. This indicates that although government expenditure increased money income, sufficient inflationary pressure on prices was created to force the consumer price index up faster than money income. As a consequence, government expenditures had a positive impact on money income, but a negative impact on real income for the period under study. The multiple R^2 is 0.89 and the regression is significant at the 99 percent level. The commercial import equation,

$$M_t^o = 27.84666 + 0.09045\ P_t^c - 0.14608\ Y_t + 0.03172\ P_t^r$$

indicates that imports vary inversely with per capita level (Y_t) and directly with cereal prices (P_t^c) and other food (P_t^r).[1] The multiple R^2 is 0.77 and the regression is significant at the 99 percent level. The stocks equation,

[1] Alternative forms of the import equation were considered which included concessional imports and the ratio of cereal prices to other food prices, but regression coefficients for both were insignificant even at the 50 percent level.

$$W_t = -1.52758 + 0.97393\ Q_t^c - 0.53062\ M_t^o - 1.62118\ C_t^p - 0.89938\ M_t^p,$$

indicates that withdrawals from government stock (W_t) are directly related to distribution through the fair price shops (Q_t^c), and inversely related to commercial imports (M_t^o), internal procurement (C_t^p) and P.L. 480 imports (M_t^p).[1] The multiple of R^2 is 0.84 and the regression is significant at the 99 percent level. The identity equation.

$$Q_t^d + Q_t^c - Q_t^s - M_t^o - W_t - M_t^p = 0$$

states that demand on the open market (Q_t^d) plus distribution through the fair price shops (Q_t^c) cannot exceed domestic supply (Q_t^s) plus imports (M_t^o and M_t^p) and withdrawals from government stocks (W_t).

The coefficients from the reduced form of the system of equations, Table 6, which are of particular interest to this study, are those associated with variable M_t^p or P.L. 480 imports. The coefficients, or impact multipliers, from the reduced form model indicate that increasing P.L. 480 imports by one kilogram per capita[2] would depress cereal prices by 0.1314 units (Π_{47}) of the price index but increase demand by 0.0727 kilograms per capita (Π_{27}) and concessional distribution by 0.8577

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[1] Alternative forms of the withdrawal equation were considered which included consumer demand factors such as prices of cereal and other food and income levels, but none of the regressions of this nature produced ratios of regression to residual sum of squares which exceed 1.0, and consequently were insignificant.

[2] The average population of India for the period studied was 450.48 million so that imports of one kilogram per capita involves 450.48 thousand metric tons of cereal.

Table 6. Estimated reduced form coefficients to measure impact of P.L. 480 imports on the Indian economy, 1956-1967

	Intercept	T_{t-1}	R_{t-1}	P^r_t	P^p_t	C^p_t	M^p_t	G_t	P^c_{t-2}	Q^i_t
Q^s_t	-13.8934	0.0912	0.5681	0.0	0.0	0.0	0.0	0.0	0.2442	0.0
Q^d_t	-5.9595	0.0847	0.5275	0.0168	0.0054	-1.5250	0.0727	0.0	0.2268	-0.0043
Q^c_t	7.2528	-0.0349	-0.2173	0.0162	-0.2250	0.7989	0.8557	-0.0001	-0.0934	0.0391
P^c_t	133.6264	-0,0569	-0.3547	0.5578	-0.0098	2.7561	-0.1314	-0.0012	-0.1525	0.3815
Y_t	107.7947	0.0730	0.4547	0.0	0.0	0.0	0.0	-0.0009	0.1955	0.2839
M^o_t	24.1866	-0.0158	-0.0985	-0.0368	-0.0009	0.2493	-0.0119	0.0	-0.0424	-0.0070
W_t	56.2758	-0.0256	-0.1593	-0.0038	-0.2189	-0.9754	-0.0597	-0.0001	-0.0685	0.0418

kilograms per capita (Π_{37}) so that 92.84 percent of the increase in P.L. 480 imports would result in increased consumption.

To measure the price impact in succeeding years, it is necessary to use an interim multiplier which, for price in this model, equals $\Pi_{47}\ \Pi_{49}^{\frac{1}{2}p}$ where p = 0, 2, 4, ... because of the two-year lag between P_t^c and P_{t-2}^c (63, p. 139). Therefore, the interim multiplier for cereal price would be 0.020039 in the second year, -0.003056 in the fourth year, and 0.000466 in the sixth year. The first interim multiplier represents a change of less than three hundredths of 1 percent using the mean value of the price index, and the multiplier values in succeeding years are essentialy zero.

The impact on supply is measured by the interim multiplier $\Pi_{19}\Pi_{47}\Pi_{49}^{\frac{1}{2}p-1} + \Pi_{16}$ where p=2, 4, ... because of the time lag of price impact on production (63, p. 141). Evaluated at p=2 to measure the impact of a change in price during the period where P.L. 480 imports occur upon production two periods later, the interim multiplier is -0.032088. In other words, each ton per capita of cereal which was supplied through P.L. 480 to India has depressed domestic production by 0.032088 tons per capita during the production season two years later. Similarly, at p=4, the multiplier would be 0.004893 so that P.L. 480 imports of one ton of cereal would result in 0.004893 tons per capita of increased cereal production. At p=6 the multiplier is again negative at -0.000746. In quantity terms at the mean population of India for the period under consideration (450,480 million), P.L. 480 imports of

450,480 metric tons (one kilogram per capita) of cereal are estimated to have depressed domestic production by 14,455 metric tons two years later, increased production by 2,204 metric tons four years later and depressed production by 336 metric tons six years later.

The net impact on supply is more accurately measured by the sum of the interim multipliers over severl years. Each kilogram of P.L. 480 cereal imported is estimated to have depressed production by 0.027841 kilograms so that for each kilogram per capita (450,480 metric tons) production was depressed by 12,600 metric tons over a twelve year period with the major impact coming as a result of the first and second price change.

Table 7. Total effect of P.L. 480 imports on domestic production in India

Year	Interim multiplier	Sum of interim multipliers
2	-0.032088	-0.032088
4	0.004893	-0.027195
6	-0.000746	-0.027941
8	0.000114	-0.027827
10	-0.000017	-0.027844
12	0.000003	-0.027841

Summary

The model which has been developed and evaluated above is unique from previous attempts to evaluate the impact of P.L. 480 imports on the recipient economy in that it explicitly considers the case where P.L. 480 imports are distributed to consumers in such a manner that a demand shift occurs as well as a shift in total supply.[1] As a consequence of recognizing the shift in demand as well as supply, the impact of P.L. 480 on domestic supply is estimated to be less than 9 percent of the magnitude estimated by Mann (63, p. 143) when he assumed only a shift in supply. In contrast to a reduction in domestic supply of 12,600 metric tons estimated above, Mann's interim multiplier implies a negative impact of 143,200 metric tons on domestic supply.

From an application standpoint, the conclusions of the above analysis indicate that the negative impact of P.L. 480 on domestic prices and supply can be significantly reduced if the commodities are distributed in the recipient economy in a way which creates new demand rather than substituting or competing with the existing demand. The analysis of the aggregate food market indicates that distribution of P.L. 480 commodities through fair price shops in India has provided for increased consumption amounting to 93 percent of the amount imported. Since fair price shop distribution is at a lower price than the local market price, distribution through these shops has increased consumer welfare by increasing consumption and lowering price. At the same time the distribution

[1] For a price elasticity of demand of -0.39, a decrease in price of 0.1314 implies a change in quantity demanded of 0.07227 kilograms per capite if adjustment were along the demand curve as compared to the actual increase of 0.9284 kilograms per capita which implies a shift in demand.

of P.L. 480 commodities has depressed domestic prices in the open market by only about two hundredths of 1 percent.

P.L. 480 imports of one kilogram per capita have provided an additional supply of about 450,000 metric tons from which the domestic supply reduction of 12,600 metric tons must be deducted to calculate a net short-run increase in supply of about 437,000 metric tons while depressing prices by less than two hundredths of 1 percent. On this basis, importing P.L. 480 cereal in India has increased net supply by 97 percent of each unit imported.

Alternatives for Expanding Demand Through Market Differentiation

Providing food commodities to consumers at a concessional price, below market price, improves the welfare of the consumer by increasing his potential for consuming goods and services. In general, food aid has an impact similar to cash welfare payments because it increases consumer income or resource endowment and allows demand for consumer goods to increase. With food aid the consumer can still consume all of the commodities previously choosen and be able to consume additional commodities as well. He probably will wish to increase total food consumption less than the amount of food aid by reallocating part of his previous food budget to other commodities. The consumer will not choose to reallocate so much of his food budget that he reduces his total food consumption below previous levels because this suggests that he was irrational in allocating his original budget. The reallocation of income to purchase other items indicates that the consumer will

demand more of each commodity, including food, at the same price and hence a shift in demand rather than a movement along a given demand curve. If the presence of the food aid commodities in the economy produce a food price decline, the consumer may also choose to expand his food consumption, but in this case the adjustment will be along a given demand curve rather than a shift of the demand curve. As a result, distribution of food aid may increase the demand for food either through a shift in demand or a downward movement along the demand curve.

Experiences with U.S. programs

As in the case of surplus disposal legislation which preceded P.L. 480 concepts and principles can be drawn from operational experiences with welfare programs in the U.S. which provide a basis for developing distribution programs for food aid in recipient countries. Two basic programs, direct distribution and food stamp plans, have been used in the U.S. to expand demand of low income groups. As described in Chapter II, direct distribution of food to the needy originated under the authorization of Section 32 of the Agricultural Act of 1935. Direct distribution was designed to serve two primary objectives: (a) to remove conditions from government stocks which had been accumulated by the government through price support activities, and (b) to provide food commodities to needy families to help improve their level of welfare.

The original food stamp program began in 1939 with similar objectives which included: (a) expansion of effective demand for farm products, (b) distribution of food to undernourished families, and (c) utilization of the existing marketing channels to distribute food. The food stamp

plan, as operated in the U.S., has utilized regular retail outlets for distributing the food rather than requiring special food lines or distribution centers.

From the standpoint of administrative costs, complete data is not available to evaluate the total costs of both programs, but some reasonable conclusions can be drawn from the operational knowledge of the two programs. In both cases, consumers who are eligible to participate in the programs must be identified so there should be no major cost differences in this aspect of the programs. In contrast it is likely that purchasing, processing, storage, and distribution of food will cost considerably more for direct distribution through special centers than the comparative costs of printing, distribution, and redemption of stamps for the food stamp program which operates through retail distribution stores. Consequently, "marketing costs" per unit of food would be considerably higher for direct distribution than a stamp plan (46, p. 2).

To evaluate the comparative efficiency of the two programs, several factors must be considered. To achieve efficient allocation of resources from a consumer's standpoint, the distribution program should allow a consumer to express his personal tastes and preferences given a set of market prices. In particular, the last dollar spent on each class of goods should provide the same satisfaction to the consumer for all classes of goods.

Relative to cash welfare payments, direct distribution restrcits consumer freedom. If the food items given to the consumer are items which he would otherwise choose to purchase, the direct distribution is

essentially the same as a cash payment because it frees funds for reallocation to other items of the consumer's choice. In contrast the food stamp plan establishes levels of expenditure which must be made to qualify for the program, usually above preprogram expenditures. Food stamps allow for expression of preference in choosing the mix of various food commodities which is desired, but do not allow for freedom of allocation between food and nonfood classes.

On the basis of work incentive, the direct distribution program provides for no variation in the value of commodities distributed as income rises, and consequently has no disincentive effect within the range of participation (46, p. 3). At the limit of qualification for participation in the distribution program, the disincentive is substantial because of the "all or nothing" basis of the program. The food stamp program is administered with a steady decline in value of food stamps provided as income increases so that the net grain from additional income is less than the total grain by the amount of food stamps given up. The food stamp plan has a constant disincentive factor for additional work, but does not have the abrupt disincentive at the upper limit of participation which is embodied in the direct distribution program. Consequently, the two programs have greatest similarity and lack of disincentive at low income levels.

From a balanced nutrition standpoint, the two programs differ significantly in potential and actual achievement. Direct distribution provides little freedom of choice and puts the burden of balancing the diet on consumers' remaining resources or the administrators of

the program who determine the mix of food commodities which will be distributed. Assuming the recipient has no other resources to allocate for consumption, the nutritional considerations rest with the program administrators. The potential exists for a balanced diet to be provided with the consumer having little opportunity to misallocate resources and avoid a diet of nutritional balance unless the recipient wastes or sells part of the commodity bundle. In practice, however, commodities have often been selected for distribution on the basis of their status as surplus stocks rather than their contribution to balancing the diet of the recipients.

On the other hand, the food stamp plan provides the opportunity for the recipient to choose among a wide range of food products and achieve a balanced diet. The same freedom provides the opportunity for misallocation of resources and consumption of a diet far from nutritional balance. The extent to which administration of the program allows for determination of the commodities which are made available, and the extent to which nutritional standards are to be imposed on the recipient, determine the rating of the two programs from the standpoint of achieving adequate diets.

As alternatives to the current welfare programs which involve distribution of food commodities, Hoover and Maddox have suggested three types of food stamp programs (46, pp. 7, 34). The three programs include (a) a fixed purchase plan, (b) a free stamp program, and (c) a variable purchase plan. The fixed purchase plan would provide sufficient free stamps to families who are without income to allow for the purchase of a nutritionally adequate diet. Families with incomes less than 3.3

times the cost of a minimum diet would receive some free stamps in addition to the purchased stamps. To the extent that the minimum expenditure on food would be lowered from 40 percent to 30 percent, the program would provide for greater freedom of allocation between food and nonfood commodities for families with some income. At the same time the stamp plan would provide greater consumer freedom of choice than direct distributions.

The free stamp plan would give enough free stamps to families or individuals below a specified poverty line to purcahse an adequate diet. Individuals or families above the poverty level would receive a smaller amount of free stamps on a graduated scale until the amount of stamps diminished to zero at some specified higher income level. The free stamp plan would again provide for considerable consumer freedom of choice. Free stamps could expand demand beyond the quantity which would be purchased if cash payments were made, but this becomes a question of comparing a gain in individual consumer welfare with a loss in welfare for the society as a whole resulting from the misallocation of resources. Greater participation would be anticipated under the free stamp plan than the fixed purchase plan because no specified private expenditure of income is required for participation in the program.

The variable purchase plan is similar to the fixed purchase plan in that stamps must be purchased for families above a specified poverty level. As in the fixed purchase plan, stamps would be given to families below the poverty line. Above the poverty line stamps would be available

at varying rates per dollar of face value depending on the income level of the recipient with the scale going from zero to $1.00 as income increased. Under this plan, the consumer could choose the amount of stamps desired rather than being faced with an all or nothing package. As with the preceding plans, the variable purchase plan would allow for expression of consumer choice in selecting the desired food bundle, but also provide maximum freedom in choice between food and nonfood commodities. If stamps are sold rather than given away, the misallocation of resources would be minimized. Maximum consumer choice could be exercised under the variable purchase program so that the anticipated participation would be greater than under a fixed purchase plan but less than the free stamp plan. Sale of stamps above a specified poverty line would further reduce the cost of the variable purchase plan so that a choice between it and the free stamp plan as possible distribution plans would rest on the relative weights of participation as opposed to cost and efficiency of resource allocation.

Applications for developing countries

The two distribution programs which have been utilized in the U.S. to provide welfare benefits to low income recipients and expand the consumption of food provide a model for developing differentiated markets in developing countries. The essence of supplying food aid is to increase consumer welfare without having a negative impact on producer welfare through depressed prices of agricultural commodities. One method of accomplishing both objectives is to achieve sufficient market differentiations so that price discrimination can be practiced in distributing P.L.

480 imports without replacing existing effective demand. Realistically this can only be guaranteed when food is distributed to consumers having no income so that there can be no reallocation of income which would have been spent on food to purchase other commodities.

In practice the development of a differentiated market can be expected to compete for some of the existing effective demand, so that the objective is to satisfy a demand which is supplementary to the existing demand. In the U.S. the direct distribution programs have basically achieved increased consumption and consumer welfare because of the very low income levels of recipients to whom food was supplied. The same program applied to higher income recipients could have been much more competitive with the existing demand for food because of income reallocation, and consequently a smaller increase in total food consumption.

A similar response with respect to income levels can be expected in the developing countries. Distribution of food to very low income consumers in India, Pakistan, Korea, or other developing countries should expand total food consumption by an amount close to the quantity of food distributed. If P.L. 480 imports are distributed to consumers, and if total consumption of food expands by a similar amount, then imports should increase consumer welfare while having little impact on domestic prices and supply. As in the U.S., the lower the income level of the

recipients, the less chance there would be for the additional commodities to compete with domestic commodities.

Direct distribution has had the characteristic in the U.S. and would have in a developing country of limiting consumer choice in selection of a desired food bundle. This characteristic could be capitalized upon in two particular cases. In the case of illiterate consumers, supplying food in a fixed bundle which was nutritionally balanced would provide a means to achieve nutritionally adequate diets where the ability does not exist to do so by free choice. A second situation which would lend itself to direct distribution is where a particular commodity or class of food is in short supply such as high protein foods. In this case, even though there was a limitation on consumer choice, there presumably would be little objection to a distribution program to supplement existing diets and bring them up a level of balanced nutrition.

With recipients who have a minimal level of income, but need additional income to provide an acceptable minimum standard of living, the food stamp plans probably offer more potential for expanding food consumption in the developing countries while avoiding negative price impacts of direct distribution program. First, the stamp plans provide for freedom of consumer choice in filling the food basket. Secondly, a stamp plan for distribution of P.L. 480 imports through the retail stores would simultaneously provide for improved consumer welfare and a stimulus for developing the marketing distribution system.

Stamp plans can provide for differentiated product preferences by providing various numbers of different classes of stamps to the consumers.

If the consumers in the recipient countries visualize P.L. 480 imports as inferior to the local commodities, two classes of stamps could be used so that one could be redeemed only for the purchase of P.L. 480 commodities while the other is good for all food commodities. For use with illiterate recipients it should be easy to color code the stamps and commodities so that color association is all that is necessary to distinguish between commodity groups.

A food stamp plan such as the variable purchase plan discussed earlier would not provide a disincentive for the recipients to work and thus create a chronic welfare problem. The variable purchase plan would also require a minimum amount of government subsidy for operation, and make the government costs primarily a function of the extent to which it chooses to subsidize recipient income.

The fair price shop distribution used in India and analyzed in the first part of this chapter represents still another means of differentiating the market. The principle behind the fair price shops and their use is that the P.L. 480 imports which are distributed through them are, at least in the eyes of some Indian consumers, a different product than the domestic cereals sold on the open market. As such, a lower price can be charged at the fair price shops for wheat, rice, and other cereals without experiencing a complete substitution of concessional purchases for open-market purchases.

Distribution of food through the fair price shops has had some negative impact on prices in the open market as the result of part of each unit of P.L. 480 cereal (0.1443 units) finding its way into competition

with domestic commodities.[1] In India, the distribution of P.L. 480 commodities through the fair price shops is estimated to have resulted in a net income in food consumption equal to about 93 percent of the concessional imports. Over 85 percent of the P.L. 480 commodities reach consumers through the fair price shops without competing with domestic commodities. The remaining 8 percent is purchased by consumers who replace their open-market demand with purchases from the fair price shops, shifting the open-market demand curve to the left.

The fair price shop method of distribution allows maximum freedom of choice for consumers with an income. Pricing commodities below open-market price provides a welfare aspect to the distribution of P.L. 480 commodities, but not nearly as much as direct distribution or stamp programs. The fair price distribution functions on the basis of an effective market demand so that it represents a secondary marketing system based on a differentiated product and reduced prices. Because the distribution method does not involve an income subside as large as the other programs discussed, costs of operation would be limited to procurement of the P.L. 480 commodities, operation of the fair price shops, and a price differential between P.L. 480 contract price and fair price shop price.

Unless the fair price shop system is to be developed as a means of increasing employment, it appears that program costs could be reduced

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[1] The amount of P.L. 480 commodities which compete in the open market is indicated by the deviation of the value of Π_{37} (Table 20) from unity.

even more if the retail marketing system is utilized to distribute P.L. 480 commodities under the same price control policies exercised in the fair price shop. Allowing the commodities to be distributed on the basis of effective demand, at a reduced price, would minimize administrative costs associated with identifying and distributing food or stamps to needy families. On the other hand, use of the fair price distribution alone would not provide the opportunity to deal with individuals or families without sufficient income to purchase an adequate diet even if all their income is used to purchase low priced P.L. 480 commodities.

Summary

Three major programs or plans have been discussed as possible methods of expanding consumption of P.L. 480 commodities while minimizing negative impacts of the increase in total supply of cereals on prices and production. As Abel and Cochrane have pointed out, attaining sizable increases in food consumption through direct distribution or concessional pricing is costly and requires justification on nutritional or welfare considerations (1, p. 63). For the case of P.L. 480 distributions, the welfare considerations must include both consumers and producers.

Direct distribution provides the greatest administrative control over the food bundle provided, but for the same reason, provides the least freedom of choice for the consumer. Direct distribution could be particularly effective when dealing with illiterate recipients who lack the knowledge to select a combination of commodities which will provide a nutritionally balanced diet. Administrative costs of the program would be relatively high because of the food handling involved and the effort

necessary to identify needy recipients and the quantity of food they are to receive.

A variable purchase stamp plan would allow for the welfare aspect of subsidizing income while reducing the cost of administration by handling stamps instead of food commodities. Secondly, the distribution can be designed to utilize the established marketing system and stimulate the development of this sector of the economy as a beneficial side effect. Costs of a stamp plan could be controlled primarily by the amount of income subsidy desired for welfare purposes.

A fair price distribution program operated in conjunction with the retail marketing system would provide the least administrative control over the food bundle consumers chose, but allow the consumer maximum freedom of choice. Because of the lack of income subsidy, controlled price distribution would involve the lowest administrative costs of the three programs.

A combination of a variable purchase stamp program and a controlled price distribution program could be utilized to achieve the minimum cost distribution for the bulk of the P.L. 480 commodities and still provide for a welfare program which could be operated at various levels at the government's option. The combination program would capitalize on the market differentiation necessary to minimize the negative impact on domestic prices and production as demonstrated in the previous econometric model.

DISTRIBUTION METHODS AND THE IMPACT OF FOOD AID

The two previous sections have examined the effect of distributing food aid to consumers in recipient countries under alternative conditions to improve consumer welfare while avoiding or minimizing negative impacts on domestic prices and production. This chapter analyzes cases where even greater increases in consumer welfare are desired. Recognizing that increased gains for consumers will magnify negative impacts on prices and food supply, efficient use of food aid becomes a problem of compensating domestic producers for depressed prices and loss of income resulting from activities designed to achieve improved consumer welfare.

The use of food aid to improve producer welfare is less direct than its use to improve consumer welfare. For product welfare, food aid can be used directly to increase agricultural productivity through development projects. It can also be sold and the revenue used to increase availability of factors of production or subsidize producers' income. The impact of food aid on the economy is tied closely to the distribution methods used and the characteristics of those particular methods. In the following section, factors which determine distribution methods and specific impacts associated with those methods will be examined.

Contracting and Distribution of P.L. 480 Commodities

Under P.L. 480 as amended in 1966, food aid is supplied to developing countries under one of three Titles. Title I agreements involve government-to-government sales for cash or long-term credit, repayable in either local currency or dollars. Title II agreements involve both

government-to-government and relief organization grants for emergency relief and economic development programs. Title III agreements are government-to-government trading of food for materials and services.

Under each Title the ultimate distribution of the commodities to consumers provides an opportunity for selective distribution to specific classes of consumers characterized by different income levels and physical ability to work. The three primary distribution methods include grants, wages-in-kind, and open market sales. Although any or all of these Titles can be used, certain combinations or sets may be preferred for a given situation. In case of Famine relief the U.S. has frequently contracted food under Title II agreements which in turn allow the recipient country to give the commodities to consumers on a grant basis. In contrast, when the recipient country proposes a grant program, but the U.S. will not contract Title II commodities, the recipient country is forced to assume an immediate liability by supplying materials and services under Title III or a long-term liability under Title I. If Title I or Title III commodities are supplied to consumers on a grant basis by a recipient government, liquidation of the liability may be difficult and indirect at best.

Under certain circumstances the U.S. will supply commodities for work projects under any of the three Titles. Work projects may be used as emergency relief when capable workers are available to supply labor in return for wages-in-kind. In such case, the U.S. may contract food under Title II to ease famine, provide emergency relief, or promote economic development. Work projects do not automatically qualify for Title II commodities since they are not necessarily associated with

emergency situations set forth in Title II. Work projects are an effective way of utilizing a large labor supply which is willing to accept wages-in-kind. Consequently, it may be necessary to contract for the food under Title I or Title III. Title I contracts for long-term credit are particularly compatible with work projects since the projects are often of a social overhead investment nature and associated with long, indirect payoffs.

Commodities for open market sales may be contracted under all three Titles. In cases where short-run emergencies arise, but income levels are not a crucial problem, Title II contracts may be used to supply commodities which will be distributed through normal market channels. However, there has been considerable reluctance on the part of the U.S. to contract on this basis since the recipient government generates revenue from the sale of the commodities without assuming any significant liability. Title I and Title III sales more nearly satisfy the intent of P.L. 480 contracting when normal market procedures are used to distribute the commodity aid.

Alternative Distribution Methods and Their Characteristic Effects

Although several alternatives exist for contracting food aid from the U.S., the primary impact which it has on the recipient economy depends on the distribution methods used. These in turn are closely related to the specific consumer group which is reached and the extent to which productive resources are activated. Considerable similarity exists between the three distribution methods most widely used for P.L. 480 commodities in recipient countries--grants, wages-in-kind, and open

market sales--and those used in the U.S. Grants for emergency relief or welfare benefits to low income families are similar to the direct distribution programs used in the U.S. Wages-in-kind programs are similar to the stamp plans since both are designed to distribute commodities at some cost to the consumer. On work projects the recipient is required to work in order to receive food or other commodities which is similar to a food stamp plan where the recipient is required to pay a percent of his income to participate in the program. The value of commodities the work project recipient receives determines the extent to which wages-in-kind tend toward an income subsidy. Open market sales fall into the concessional sales groups discussed in Chapter IV. Depending on the price charged for the P.L. 480 commodities as compared with the price of similar domestic commodities, sales through retail markets may or may not have a concessional aspect.

Grants and donations of food commodities

Distribution of food aid through grant programs has primarily been used to supply food to a broad class of consumers which are incapable of supplying labor to earn cash wages or wages-in-kind. The primary recipients are children, pregnant women, senior citizens, and the handicapped. As a group, these recipients are normally characterized by very low incomes so that their marginal propensity to consume food would approach 1.0. As a result of the high preference for additional food, grants of food would have little impact upon demand for nonfood items. Because the recipient group is physically incapable of supplying labor, distribution through grants to this group has no direct impact

on domestic supply of agricultural or industrial commodities. In the short run food grants shift the total food supply (domestic production plus concessional imports) to the right by an amount equal to the food aid, but since the food is given directly to the consumers, the grants also shift demand to the right by a similar amount.[1] Consequently, with very low income consumers receiving food grants, the impact of food aid on the economy would be negligible. The additional food supply in the market system has little effect because the income effect of the grants motivates consumers to increase their demand by a similar amount. As a result of an equal shift in supply and demand, there would be no price effect to stimulate additional demand for domestic food and likewise no price effect to disrupt domestic supply. With the strong preference for food, grant recipients would not trade away any significant amount of food for nonfood items so there would be no effect on demand for output from the industrial sector. With no change in prices or domestic supply, there would be no effect on income in either the agricultural or industrial sector aside from the increase in income realized by the grant recipients. From a welfare standpoint, the grants would have an immediate impact by increasing food consumption for the recipients, but would have no lasting positive impact after the grants were discontinued. Upon termination of the grants, total supply would shift back to the domestic and commercial import level. The loss of income in the form of food grants would likewise shift the

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[1] The shift in supply results from adding a given quantity of imported commodities to the domestic supply. The shift in demand results from the distribution of commodities, which have real value, to consumers. The increase in resource endowment or real income results in a shift in the demand curves of consumers receiving the grants. Summing over all consumers for the aggregate demand curve, aggregate demand shifts also.

effective demand back to the levels which existed before the availability of the grants. The only lasting effect of the grants would be the investment in human capital. Supplying the grants could improve nutritional levels of recipients and potentially contribute to the development of a productive resource, labor, which would ultimately contribute to increased domestic output.

The relationship between nutrition and productivity has been cited for several countries as a part of the Freedom from Hunger Campaign (33, pp. 13-25). Coal miners of the Ruhr district in Germany demonstrated increased productivity of up to 13 percent for a 10 percent increase in calories. A group of railroad construction workers in the U. S. increased output 22 percent for a 10 percent increase in calories. Providing rations to South African miners of approximately 4500 calories per day increased productivity more than adequately to compensate for the additional cost. In Ruanda Urundi one cooked meal per day supplied to workers was sufficient to increase productivity by 30 percent. In Zanzibar well balanced meals for the workers increased productivity more than enough to pay for the added cost even though the meals increased labor cost by 50 percent. The availability of liberal diets for rubber plantation workers in Viet Nam increased productivity by 50 percent. Srivastáva cites an Indian study which estimated a 2.27 percent increase in worker productivity for a 1.0 percent increase in calorie intake (73, p. 97).

These examples deal with the productivity of labor as engaged directly in the production of goods or services. As such the impact of additional

food is measured as an increase in labor units or as increased productivity of each unit, depending on the way labor is measured in the production process. In all of these examples, increased productivity of workers already employed was being considered. However, in most developing countries with a sizable portion of the total labor force unemployed, food aid is programmed not as a means of expanding the output of the work force, but to reach unemployed or underemployed laborers, and when possible to bring them into production in such a way as to contribute to development. Although food aid could be used to contribute to increased labor productivity, the examples used in this study will assume an excess of labor so that emphasis is on increasing employment opportunities rather than labor productivity. It is assumed that labor provided in exchange for food aid is utilized in social overhead investment projects to develop resource supply or improve resource quality rather than direct engagement in the production of goods or services as demanded by the consumer.

In general, the impact of increased labor productivity can be summarized as follows. If labor productivity increased and economic distribution of the gain is based on productivity, workers will receive higher incomes. Assuming a positive rate of profit retention or savings so that increased expenditure is less than marginal value product, supply will shift to the right more than demand, resulting in lower prices. The lower price level represents an increase in real income level and consumer welfare. At the same time the lower prices would have a negative impact on domestic production in future periods, depending on the supply elasticity of producers.

Although food grants have traditionally been supplied to consumers at extremely low income levels, grant programs could be designed to reach consumers who already have some minimum level of income. In this case the consumers' marginal propensity to consume food would be less than 1.0, and the income effect of food grants would shift demand by a smaller amount than the exogenous supply shift, implying a new equilibrium at a lower price. When the demand and supply shifts are not equal in magnitude, the new equilibrium price is determined by the relative magnitudes of price elasticity of the demand function and price elasticity of the supply function. A simple partial equilibrium modelcan be developed to evaluate the impact of supply and demand shifts. (42, p. 49)

As the income of recipients increases, marginal propensity to consume food decreases and the resulting negative impact on prices would increase also. Lower prices imply less domestic production where prices and production are positively correlated, so that income to farmers would fall in all cases where price elasticity of demand is less than zero.[1] The smallest impact on income to the agricultural sector would be where demand expanded by the amount of food aid distributed and domestic demand would be unaffected. As the average income of the recipient group increases, agricultural income would fall because of the declining marginal propensity to consume food and falling prices for smaller quantities of production.

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[1]See Appendix E for evaluation of price, production, and income effects at alternative income levels.

The lower revenue of the agricultural sector implies a decline in welfare level for agricultural producers unless out migration occurs at a rate which is equal to or greater than the rate of decline in total income to the agriculture sector. Consumer welfare, on the other hand, is increased as a result of the food aid grants. Consumers who receive food directly realize higher levels of welfare through the income effect of the grants. At the same time consumers who do not receive the grants realize an increase in their welfare through lower food prices. In aggregate, consumers are able to consume more food for less money, and consequently can expand nonfood consumption as well.

The welfare impact of distributing P.L. 480 imports as food grants is almost exclusively short run. The increase in supply and the shift in demand are direct functions of the availability of the food grants. As soon as the grants are interrupted, supply and demand will revert to the previous levels and the improved welfare position will be lost. Three exceptions are notable as long-run effects of the food grants. First, people in both developed and developing countries have a strong tendency to resist backward movement. If the grants continue for an extended period of time before interruption, it is possible that the higher consumption level and adjusted patterns will have a permanent effect on the tastes and preferences of the individual consumers so that their demand schedule for food, nonfood, or both may experience a permanent shift. Secondly, if the food used for grants is initially secured under a grant agreement to meet an emergency supply deficit, it may substitute for commercial imports which the government would otherwise

be forced to purchase. Such emergency imports could result in diversion of scarce foreign exchange from investments to promote development and have the long-run effect of slowing developmental progress. Depending on the allocation of the added government investment for development, output from either the agricultural sector or the industrial sector may be increased during the period of food aid availability, so that after termination of food aid, supply may not return to its original position. Third, providing food grants may have an impact on labor productivity through improved consumption levels, and in turn on level of income received. The increases in income and productivity may have a lasting effect of shifting both the demand and supply curves to the right of their original position.

Work projects which utilize food aid as wages-in-kind

Unlike distribution of food aid through grant programs, distribution through work projects implies a more restricted group of recipients. Work projects basically limit recipients to the same individuals who would be available to earn regular wages if such employment opportunities existed. Although it is possible for work projects to be competitive with other job opportunities, this should not be the case unless wage-in-kind rates are set above competitive wage rates. The shift of previously employed workers to work projects would be inefficient because of the transitional employment which it would create and the effect of locating 'permanent' employees in 'temporary' employment provided by work projects. Establishing wage-in-kind rates below competitive wage rates would offer a greater attraction for unemployed and underemployed workers to take

advantage of the opportunities available through the work projects than for those who are employed.

Wage-in-kind payments have essentially the same impact on consumption patterns and domestic production that grants do, with one major exception. In both cases distribution of food aid commodities represents a shift in the aggregate food supply of the recipient country, and a shift in demand depending on the marginal preference to consume food from incremental income. The intersection of the two new schedules determines the new price and quantity relationship which will exist after the shift. The difference occurs in the additional shift in the supply curve which is directly related to the use of the labor provided for the project.

The amount of permanent or long-run shift in supply which is achieved depends on nature of work projects which are financed with food aid. The three broad classes include direct production, short-run overhead, and long-run overhead. The direct production involves labor utilization to provide goods and services for immediate consumption. Using food aid to finance direct production would have the greatest impact on short-run supply but the least impact on long-run supply.

Short-run overhead investments might include construction of dams and irrigation canals, clearing land for cultivation, building a fertilizer plant, or similar projects which are relatively short-run in nature and would have a direct effect upon production in the immediate future. Long-run overhead investments might include construction of modern transportation systems, building schools, training teachers,

construction of improved housing, and similar projects which affect the welfare of the people but have a much longer and indirect impact on productivity of human resources and ultimately the supply of goods and services which are produced.

The impact on productivity also is a function of the allocation of work projects between the agricultural sector and the industrial sector. It is possible to allocate a major portion of the investment to the agricultural sector so agricultural production would be directly affected. On the other hand, all of the work projects might be allocated to the industrial sector so that agricultural output was unaffected.

Consequently, the impact of P.L. 480 commodities on agricultural supply, when used to finance work projects, depends on the allocation of the projects between sectors, the relation between nutrition and productivity, and the rate at which the projects mature. Examples of work projects which have been used to develop factors of production in agriculture include land clearing and drainage in Colombia, forest development in Japan, and electric power development in Pakistan and Brazil.

As in the examples where P.L. 480 commodities were distributed as grants, adding food aid to the system would shift the total supply schedule to the right. Use of the food as wage-in-kind increases real income of recipients and shifts the aggregate demand function to the right, also. With a marginal propensity to consume food of less than 1.0, the demand curve would shift to the right by some amount less than the supply shift. Since food aid supplied as wages-in-kind is relatively difficult to exchange on the market for other commodities, most of it will

be consumed directly by the recipient with any marginal allocation of income for nonfood commodities coming at the expense of domestic agricultural production. Any decline in demand for domestic agricultural commodities will, of course, have a negative impact on prices and ultimately on production. Although a decline in agricultural prices would shift the terms of trade in favor of food for consumers and stimulate an increase in quantity demanded, price elasticities of less than 1.0 exclude the possibilities of maintaining preprogram income levels for agricultural producers.

The productivity of work projects and their distribution among sectors of the economy determine the endogenous shift in supply which will result. The more projects allocated to agriculture and the greater the productivity, the greater the supply shift and the lower prices. As a result of corresponding decreases in domestic supply and inelastic demand, income to agricultural producers decreases as the number of projects and their productivity increases. In nearly all cases analyzed in this study, the increase in productivity resulting from the development projects would more than offset the decline in production associated with a price decline, so that if prices were supported for the producer, agricultural income would be maintained or increased.[1] The decline in income from sales of domestic production represents a net gain to consumers as the result of lower prices and increased supply of food, and a transfer to nonagricultural sectors if the gain in real income is reallocated to nonfood commodities.

[1] Results of analysis summarized in Table 8.

Table 8. Impact of work projects on agricultural prices, supply, and income

Income level of labor force	Impact variable	50% of projects in ag. Expected supply increase 2 %	5 %	10 %	100% of projects in ag. Expected supply increase 2%	5%	10%
	Price	-2.4	-3.4	-5.1	-3.1	-5.1	-8.3
$75	Supply	0.0	1.0	2.7	0.7	2.7	6.1
	Income	-2.4	-2.4	-2.5	-2.4	-2.5	-2.7
	Price	-3.7	-4.9	-6.9	-4.5	-6.9	-10.6
$250	Supply	-0.2	0.4	1.9	0.0	1.9	5.0
	Income	-3.9	-4.5	-5.1	-4.5	-5.1	-6.1
	Price	-4.9	-6.4	-8.7	-5.9	-8.7	-13.1
$450	Supply	-1.1	-0.3	1.0	-0.6	1.0	3.7
	Income	-6.0	-6.7	-7.8	-6.5	-7.8	-9.9

To this point, the source of the labor for work projects has only been considered by income level. If all labor comes from agriculture, agricultural income increases by the additional value of food aid. The additional income from the work projects offsets the income loss in all cases where work projects draw labor from the low income group and most cases where labor is supplied by the medium income group (see Table 8). Consequently, using food aid for work projects in agriculture by hiring labor from the agricultural sector will increase agricultural output, lower food prices, increase total income to the agricultural sector (taking into consideration the value of wages-in-kind), and increase income to the nonagriculture sector. Programming food aid in this manner would improve welfare on a pareto optimal[1] basis because welfare would be increased for both agricultural producers and consumers. If labor for the work projects is drawn from the nonagriculture sector, the program does not necessarily have a net positive effect. Transfer of income from agriculture to nonagriculture has no effect on balance, but the additional food aid has a positive effect on consumers outside of agriculture. Determining the net impact in this case involves comparing a gain for one group in the economy with a loss for another group. Although aggregate measures of welfare indicate a gain, it is difficult if not impossible to measure real net gains because of the need to make interpersonal utility comparisons.

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[1]Movement toward a pareto optimum position requires that you make at least one individual better off without anyone else being made worse off.

Open-market sales to augment domestic supply

Distributing food aid through open-market sales at competitive market price affects the supply side of the food market exclusively. Introducing food into the market shifts the aggregate supply to the right in the same manner that grants and wages do. However, with open-market sales there is no associated shift in demand resulting from an increase in consumer income level. Open-market sales also take income out of the private sector and transfer it to the public sector. The extent of the food aid impact on prices determines whether the income transfer will result in a loss for both the agricultural and industrial sector or just for the agricultural sector. The other aspect of open-market sales concerns the use which the government makes of the revenue that is collected from the food sales. It is entirely possible for the government to use the food revenue to finance overhead investment projects identical to those financed with wages-in-kind. If so used, the revenue will presumably produce the same types of shifts that result from wage-in-kind financing. On the other hand, the government is free to use the revenue to finance any other type of government activities. In theory, it is possible for the government to use the revenue to relieve taxes paid by the public and actually achieve an income effect which will equal grants or wages-in-kind. In practice, it would be difficult to reach low income consumers in this way since they are usually only marginally affected by taxes if at all. Another reason this approach is not widely used is that the U.S. attempts to remain involved in the disposition of the funds which are

generated from sales. Allowing the revenue to be used as tax relief quickly incorporates the funds into the internal budgeting of the recipient country and removes it from U.S. influence. The most common contracting arrangement involves the designation of the funds for specific development projects even before the food is granted in an attempt to insure that the food will make a contribution to development and not just lead to expanded consumption.

Sales on the open market will of necessity reach consumers who have an income and are operating in the market system. With this method it becomes more difficult to regulate the composition of the recipient group than with the grants and work projects, but techniques such as food stamp plans or other types of regulatory authorization can be used to influence the characteristics of the recipients. Another control technique is to distribute the food aid through government regulated shops such as the fair price shops in India but at competitive market price. Distribution through a government shop system would enable a relatively close control on recipient groups so that income stratification of recipients is also possible with the open-market system.

Analyzing distribution through open-market sales and the subsequent use of revenue to finance development projects, the additional supply of commodities is sufficient to depress agricultural income by about the amount of food aid sold when labor for the development projects is supplied by consumers with low incomes. Because of the lower marginal propensity to consume food, drawing labor from higher income groups would

Table 9. Impact of sales on agricultural prices, supply, and income

Income level of labor force	Impact variable	50% of projects in ag. 2 %	5 %	10 %	100% of projects in ag. 2%	5%	10%
	Price	-4.4	-5.4	-7.1	-4.8	-7.1	-10.2
$75	Supply	-0.9	0.1	1.9	-0.2	1.8	5.3
	Income	-5.3	-5.3	-5.3	-5.0	-5.4	-5.4
	Price	-5.2	-6.4	-8.3	-6.0	-8.3	-11.9
$250	Supply	-1.2	-0.3	1.3	-0.6	1.3	4.3
	Income	-6.3	-6.6	-7.1	-6.5	-7.1	-8.1
	Price	-6.3	-7.7	-10.0	-7.2	-10.0	-14.4
$450	Supply	-1.7	-0.9	0.4	-1.2	0.4	3.1
	Income	-7.9	-8.5	-9.7	-8.4	-9.7	-11.8

result in even lower prices and a greater depression of agricultural income. Consequently the distribution of food through open-market sales results in similar, but stronger, effects on the agricultural sector than distribution through work projects. In both types of distribution the price of food is driven down and domestic supply forced below preprogram levels in most cases. In the open-market sales case, the income loss exceeds the value of the food-aid input cases so that even if all work projects utilized labor from the agricultural sector, the total income to the sector would be lower than preprogram levels. Regardless of who received the extra income from the projects, it is consumers who realize improved welfare through lower food prices, and the nonagriculture sector which increases its total sales.

Impact on Third Country Trade

Another aspect of the impact of food aid is the effect on commercial imports of food. Through the previous discussion it has been implied that total food supply comes from domestic sources except for food aid and consequently any decline in prices and income falls directly on domestic producers. This implies that there is not a food deficit in the country. On the contrary, most developing countries have serious food deficits and are forced to use both commercial and concessional imports to meet demand so that part of the income does not go to domestic producers at all, but to foreign exporters. If the country is currently importing food, an increase in domestic supply has a quite different meaning than discussed earlier. Instead of increases in supply

forcing prices down, commercial food imports can be replaced by domestic production. Domestic producers benefit by an increased share of the total market. In this case the benefit goes to producers, and consumers are left in the same position, a pareto optimal outcome. Actually, a reduction of imports could be planned to lag expansion of domestic production with some price decline. Consumers could then gain some benefits from the shift.

The relative positions of domestic supply and demand are critical in determining how agricultural producers will be affected. Supply expansion can have a positive effect on agricultural income and the foreign exchange position of a developing country until all effective domestic demand and opportunities for commercial exports are satisfied. At that point expanded production will reduce income to agriculture. If food imports are reduced at a rate slower than domestic supply (net above demand expansion) increases, it may also be possible to achieve net gains for consumers as well as producers.

P.L. 480 and the guidelines set forth by F.A.O. for programming surplus commodities require that all possible caution be exercised to protect third country trade. The third country restriction is not consistent with optimum development planning strategy, since most developing nations have large budget and foreign exchange allocations for food imports and stand to gain in both the short and long run by reducing commercial imports. If supply, including commercial and concessional imports, expands so that it exceeds demand at the current price level, commercial imports could be reduced and bring about a savings

of foreign exchange which could be used to expand development programs.

If short-run benefits for consumers are not the main focus of a development program, close government regulation of imports could be used to maintain food prices at precontract levels so that the additional food supply would not lower prices and increase quantity of food demanded. Maintaining food prices at their preprogram level while conducting a development program designed to increase consumer income would also help to stimulate more demand for nonfood items and support for the industrial sector than if the terms of trade were allowed to shift in favor of agriculture.

The commercial trade restriction was developed to protect third country exports. The impact of not protecting commercial exports depends on the third country which is involved. Where the third country is a developed nation, the consequence of reducing commercial imports may not be totally undesirable, at least in a global welfare sense. Estimates as low as 10 to 15 percent return to U.S. expenditure for food aid programs (71) suggest that a very high percent of the funds allocated to finance P.L. 480 programs actually become U.S. grants for development or welfare programs. In this view, other developed nations could contribute to the world development effort by sacrificing a portion of their commercial exports. From a practical standpoint it may make it even easier for other nations to participate since it may be considerably easier and politically more expedient for them to direct funds into domestic agriculture subsidy programs than foreign aid programs.

However, the problem is considerably more serious if the exporting

nation is also a developing nation, and the agricultural exports are a major source of foreign exchange. Most of the developing nations have a comparative advantage in agriculture and look to this sector for its primary source of foreign exchange to be used to finance its own development program. Allowing U.S. commodities to compete with the commodities of other developing countries through concessional sales contracts raises serious question about the morality as well as the economic logic of such arrangements. The seriousness of this restriction on contracting depends on the nature of the exporting nations involved.

An analysis of optimum trade patterns completed by Farmingham (37) and a later extension of that study (17, pp. 32-54) provide one basis for several conclusions about the impact of P.L. 480 shipments on third country trade. The only developing nation[1] which was projected to be a net exporter of wheat by 1975 was Ethiopia. Developed nations including Mexico, Southern South America, the European Common Market, Russia, and Australia supplied the remaining wheat exports. In a minimum cost export model, all of Ethiopia's wheat exports were delivered to nearby Sudan. Based on this analysis, P.L. 480 shipments of wheat are not harmful to developing nations unless shipments are made to Sudan. Extending the analysis of 1985, India was projected to join Ethiopia as a developing country exporter, and other 1975 exporters continued to produce surpluses. As with Ethiopia in 1975, India in the 1985 model had a distinct location advantage over the higher income nations.

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[1]Nations with annual per capita income of less than $300 were defined as developing nations.

India's surpluses were delivered to neighboring Pakistan in totality and still represented only one-eight of Pakistan's import demand. The remaining seven-eights was supplied by Australia. If shipments of P.L. 480 wheat were made to Pakistan and utilized on a diversionary basis, Australia's exports would be reduced. The conclusion is that concessional sales of wheat, even if diversionary (replacing commercial trade), would cause little or no harm to third country trade of the developing nations but would be felt by the developed nations.

The rice situation was almost completely reversed. Most of the rice exporting nations are in the developing group. If P.L. 480 shipments of rice are diversionary, they have a significant negative impact on trade of developing nations. The most obvious conclusion is that rice should seldom be supplied under P.L. 480 contracting, and when it is, extreme caution should be used to meet the additionality condition. In the interest of other developing nations it would be most helpful if the additionality condition was met in the strictest sense, that of maintaining 'normal' proportion of previous trade levels and not just maintaining past absolute levels so that they would share in any expansion of demand for food imports.

With other food grains, the situation is less clear. Projections for 1975 indicate eleven developing nation exporters with only Cambodia, Indonesia, and Thailand supplying over 100,000 metric tons. The bulk of Cambodia and Thailand grain was delivered to India with the remainder going to the Philippines and Taiwan. The Indonesian exports were also absorbed by India. The United States and Canada were the leading developed

nation exporters, but again were at a locational disadvantage to compete with the developing nation exporters. If the U.S. protected its own commercial exports in P.L. 480 contracts, shipments of other food grains to developing nations would throw the third country impact directly on Canada when dealing with countries other than India, Taiwan, and the Philippines. In those three countries caution is required to insure that all food inputs result in additional consumption and are not diversionary. As pointed out in the analysis in Chapters III and IV, it is possible to use food aid in demand expansion programs and thus satisfy the additionality clause. With particular reference to the econometric model for India, P.L. 480 imports were found to have reduced commercial imports only slightly. With a minimum effort to protect commercial trade, expanded demand would allow for expanded third country trade, as well as expanded U.S. commercial exports, to develop from the use of P.L. 480 commodities in the developing countries.

Use of Food Aid to Subsidize Production

The main emphasis of this chapter has been to evaluate the impact of distributing P.L. 480 commodities in the recipient country when no effort is made to expand demand directly. Without demand expansion to absorb the additional supply of food commodities, prices, and income to agricultural producers are depressed unless commercial exports are decreased. Any reduction in expenditure for food represents a welfare gain for consumers, but a loss of producers. In developing countries where food prices have become inflated as a result of lagging supply,

it may be desirable to lower food prices to improve consumer welfare. Assuming that producer welfare is equally important, lowering food prices for the benefit of consumers raises two questions. How can producers be compensated for resulting loss in welfare; how can domestic production be maintained if supply is price responsive?

The two broad classes of subsidies which would allow consumer prices to fall and still maintain net farm income levels are (a) income supports and (b) subsidized factor costs. Compensation systems to protect producers from income losses when retail prices decline must include incentives so that farmers or cultivators will respond. Evidence of positive economic responsiveness of farmers in developing nations is found in the Witt and Eicher study of the impact of commodity aid (113). For instance, the estimated supply elasticity was 0.91 for milk and 1.05 for eggs in Israel, 1.9 for cotton and 1.8 for sesame in Colombia. A different situation was found by Goering and Witt in a study of Colombia (40). Although the price of wheat went up by 35.3 percent, production changed by less than one-tenth of one percent. Similar responses were experienced with corn, potatoes, and beans when price increases ranged from 34 to 54 percent. On the surface, lack of response to price changes of this magnitude suggested that farmers did not respond to price incentives. Placed in context, however, the production changes are entirely consistent. During the period under consideration, 1954-1955 to 1959-1960, the index of general farm prices rose by 80 percent. Price increases for wheat, corn, potatoes and beans were all well under the average increase. Cotton, barley, and sesame all had price increases

20 to 70 percent above the general level. The response of Colombian farmers indicates that they not only responded to absolute price changes, but relative price changes as well.

The studies of agricultural productivity in various developing countries show that cultivators respond to profit incentives. Hendrix supports this view with his statement that "HYV (high yielding varieties) further reinforce the thesis that farmers in less developed countries act in a rational economic manner, maximizing their output and incomes within limits of their knowledge, resources, and opportunities..." (44, p. 8). Later in the same paper Hendrix points out that "... we note a sharp upturn in farmers' use of fertilizer in 1965-1966 following a sharp upturn in food grain prices..." (44, p. 88). The responsiveness of farmers to price change suggests that they are aware of profit maximization at least in practice and opens the door for compensation or subsidy programs which operate on the cost side as well as the revenue side.

Product price and income supports

Two major considerations form the basis for providing price supports or income subsidies to producers. One objective is the maintenance of production to provide a minimum level of commodities for consumers at a given price or within a given range. The other objective is maintenance of income and welfare levels of producers. The relative weights which are attached to each of these objectives determine the program which will accomplish the objectives at least cost.

If income level of producers is less important than quantity of production, compensation for producers can be disregarded for selected commodities, specifically those which have a low price elasticity such as cereals in India. With low price elasticity of supply, commodities could be imported under P.L. 480 and sold on the open market, with only small reductions in domestic supply. With no compensation to the producers, such a program would require limited financing depending on the level of concessional price charged to the recipient country relative to the market price which could be obtained in the country, and the quantity of imports necessary to make up for reductions in supply resulting from lower prices. Importing food at a concessional price and marketing it through regular market outlets would only augment supply in the short run, would not promote increased productions within the recipient country, and would depress income levels in the agricultural sector.

Policy makers in the recipient countries presumably are most interested in positive sum gains so that producers and consumers are made as well or better off. Likewise, they are interested in expanding domestic production to provide for import substitution. Therefore, food aid programs which will be most useful to policy makers in the recipient countries are those which maintain both supply and income of producers without increasing consumer prices. Maintaining prices for producers but allowing them to fall for consumers, provides a net gain for both, but requires a price subsidy at the farm. P.L. 480 imports offer the potential for accomplishing both objectives. P.L. 480 imports shift short-run supply (domestic

production plus imports) to the right, and if producers are guaranteed a constant price, domestic supply is unaffected so that a net increase occurs in short-run supply. If food aid is sold on the open market at a competitive price, demand remains constant and a new equilibrium is established where the original demand curve intersects the new aggregate supply curve (domestic supply plus concessional imports). With a price elasticity of demand of -0.9 as estimated for consumers with annual per capita incomes of $75, a 1 percent change in quantity supplied implies a price decline of 1.1 percent. At this rate sale of P.L. 480 commodities on the open market does not generate sufficient revenue to compensate producers for their loss of income. Additional resources must be devoted to a compensation program for producers if their welfare position is to be maintained.

Low income consumers having annual per capita incomes of $75 represent the least loss for producers or the situation where least compensation would be necessary. As the price elasticity of demand for cereals decreases with higher income levels, the potential loss to producers is even greater. For consumers with a demand elasticity of -0.7, a 1 percent increase in supply produces a 1.4 percent decline in price. With an elasticity of -0.5, a 2.0 percent decline in prices is necessary to reach the new equilibrium. In conclusion, sale of food aid commodities on the open market to expand supply and depress prices will achieve improved consumer welfare, but even if all of the revenue from sale of food aid commodities is distributed to producers, the additional revenue will not compensate them for the loss of income. Use of the open market

system of distribution is not adequate to achieve a positive sum gain for consumers and producers at the same time with price elasticity of demand less than unity.

Assuming that lower prices are desired to improve consumer welfare, alternative compensation plans could be used to guarantee producers a specific price or a specific income. Without involving government purchases and storage which have resulted in costly programs for the U.S. government with respect to its own price support programs, a price support program could be used where commodities are sold on the open market and the government provides payments equal to the difference between price received and price guaranteed. Similarly the government could do the same thing with income, ignoring prices. Of the two alternatives, the price support plan has several advantages. From a political feasibility or social acceptance standpoint, payments attached to units of production probably have better acceptance and less criticism as a 'give way' or 'donation' program than an income subsidy plan. From the production standpoint, the income subsidy plan provides no incentive to increase production for marketing purposes; price supports do provide a production incentive. Although any increase in domestic production increases the cost of the support program, it would achieve twin objectives of development by providing more food at lower prices to consumers while expanding domestic production for the benefit of producers. Cost of a price support program could be reduced by putting quotas on quantities which qualified for price support and either graduating the support downward above that level or eliminating it all together for surpluses

producer over 'usual' or average production. With a system of price supports for production, producers would be encouraged to expand production as much as possible with the opportunity to raise their income level above that received before P.L. 480 commodities were imported and distributed in competition with domestic production.

Another means of subsidizing agricultural income is to use part of the food aid imports to provide wages for work projects in rural areas. Desai concluded in this study of the Ahmednagar District in India that "...the estimated surplus labor was of the magnitude of 16.5 percent of the total working forces in agriculture" (24, pp. 154-155). If this surplus labor could be drawn out of agriculture on a part-time basis to work on projects and to be paid in food, the food aid commodities would free a share of the farmers' own production for sale instead of personal consumption and thus increase his real income even if prices fell slightly. If work projects are designed to provide improved or expanded supplies of resources for agricultural production, the supply of agricultural commodities would be expanded in the long run as well as the short run.

In summary, the number of ways in which food aid can be used to support prices or subsidize income for producers is relatively limited. Either commodities can be sold and the revenue used to subsidize production, or commodities can be supplied directly to producers as wages on the assumption that this will release domestic commodities which would have been consumed by the producer. When P.L. 480 commodities are sold on

the open market without special provision of expanding demand (shifting demand to the right), the increase in supply will depress prices and total revenue unless price elasticity of demand is greater than unity. Therefore, the sale of P.L. 480 commodities cannot generate sufficient revenue to compensate producers for their loss even if administrative cost are ignored and all revenue from P.L. 480 sales is passed on to producers. By distributing commodities through differentiated markets so that demand is expanded, price decline can be minimized and sufficient revenue provided to compensate producers. A price subsidy plan or a work project plan would stimulate production for the long run while an income subsidy plan would lack a production incentive and might even result in a disincentive to production.

Subsidization to reduce factor prices and increase resource availability

Attempts to increase farmers' net revenue do not need to concentrate on supporting product price or subsidizing income. A second approach involves efforts which will reduce unit production costs and provide for a larger profit margin even with constant prices for output. Profit margins can be increased even under declining output prices provided that costs are declining at a faster rate. The two broad approaches to reducing unit cost include lowering factor prices when facing a fixed vector of technical coefficients or increasing productivity of resources with a fixed vector of prices.

Use of food aid is applicable in both cases. In the same manner that P.L. 480 commodities could be supplied to farmers as wages-in-kind

for employment on work projects, food commodities could be distributed with various factors of production such as seed, fertilizer, chemicals, and equipment. If a given quantity of food was distributed with each unit of seed or fertilizer purchased, the real price would be reduced by the amount of savings on food cost or the value of domestic production freed for marketing rather than personal consumption by the producer. To avoid forcing retail distributors of seed and fertilizer into becoming food retailiers also, stamps or coupons could be distributed with the seed and fertilizer which were redeemable at a food distribution center. In addition to distributing stamps as a welfare program for consumers as discussed earlier, food stamps could be used as a subsidy to lower real production costs for farmers as well.

In a similar way food aid could be used to subsidize factor prices by distributing food or food stamps to seed or fertilizer dealers so that they in turn could lower prices and maintain real income. This approach parallels subsidizing prices of food for the farmer so that prices to the consumers could be lowered and improve their welfare. Food grants or revenue from food sales could be used to compensate the dealer for the difference between prices received and some predetermined price level for factors directly affecting agricultural production.

Subsidizing prices of production factors provides the opportunity for influencing the factor mix used in production by differentiating the rates of subsidization. A shift in the relative price of two factors implies a shift in the rate of use in order to maximize profits. To

the extent that agricultural producers maximize profits, factor price subsidies which change the price ratio will encourage a change in factor use. Subsidization of factors incorporating new technology at higher rates than traditional factors will promote the adoption of new technology. For example, seed for new 'miracle' varieties could be subsidized while traditional seed was not, or at least at a higher rate than traditional seed stock. The same approach could be used with new and more effective fertilizers and chemicals. Subsidizing new technology which increases yields does not compete with labor in the productive process so that a process of capital intensification is initiated which displaces labor and causes further underutilization of the abundant labor force. On the contrary, new technology which increases yield creates additional demand for labor in harvesting, processing, and distributing additional output.

A second approach to expanding supply and producers' net income involves expanding the supply of resources or factors available to producers. This approach may also lower factor prices and production costs in a competitive system. Attempts to expand resource supply lend themselves to the investment projects and work projects discussed earlier in this study. Expanding the supply of production factors may require major overhead investments which individual producers are unable to finance. A development project might involve the construction of a dam to create an irrigation reservoir and canals to distribute water, a portion of which could be financed with food aid without having a negative impact on prices and domestic supply. On the other side, the

the investment would have a long-run impact on development by increasing the availability of water for irrigation and presumably lowering unit cost through expanded production.

Land clearing and preparation for cultivation, construction of fertilizer plants, expanding the supply of improved seed, demonstration plots to encourage adoption of new technology, development of marketing and storage facilities, and improvement of farm to market transportation are all examples of projects which could be incorporated in a development plan to improve the quality of available resources, increase the availability of limited resources, or lower the cost of resources for producers. All of the projects consist of a major labor component which could be financed with food aid as wages-in-kind or sales with revenue used to pay wages. In addition, food aid could be used to satisfy demand generated by the income multiplier impact of development investment. In all of these examples food aid could be utilized to promote production by expanding resource use through increased supply and lower prices which in turn result in higher net incomes to producers.

One possible exception to the above analysis should be noted. In a number of developing countries the supply of capital inputs are available only in limited quantities. If an open-market policy has been followed so that rationing is achieved through relatively high prices rather than other forms of physical rationing, the above analysis will apply. If

on the other hand price has been fixed at a lower level which would create excess demand without external controls, and the distribution of the limited input is achieved through a systematic rationing scheme, the general analysis presented above is not directly applicable.

Rationing, other than with inflated prices, of an input short of the level demanded for profit maximization relegates that resource to the status of a fixed rather than a variable resource and sets the demand for it at the maximum amount available. With capital inputs limited at a level short of profit maximization, the producer effectively experiences a release of capital from procurement of capital inputs which enables him to allocate the additional capital for labor procurement in order to increase profit by driving down marginal productivity and consequently marginal value product of labor toward the price of labor. Profit increases with the addition of labor until the ratio of marginal value product of labor to price of labor is driven to unity or until a limit on labor supply is also reached.

With systematic rationing of resources, manipulation of the resource prices will not stimulate a change in production since prices are not the determinate of distribution, at least within a moderate range. Neither will limited manipulation of the product price have an effect on output since resources are already being used to the limit of availability. Raising resource prices or lowering output price would in fact lower profits but not affect output within a limited range.

Since increased labor use in the rationing example implies a less efficient productive process, as indicated by the lower return on capital, efficiency could be improved by increasing the availability of

capital inputs to ease the rationing restrictions and more nearly equate marginal productivity ratios to price ratios for the inputs. Increasing the supply of rationed inputs, to a level where supply and demand come into equilibrium, is one way of increasing productive efficiency and possibly output as well.

Once input prices are established in a free market, the potential exists for stimulating production through input prices. Subsidies, rebates, and tax credits are just a few alternatives for lowering the price of inputs. In terms of overall development, unequal rates of price reduction can be used to stimulate a shift in use from one resource to another. Ultimately lowering input prices has the effect of lowering cost of production so that budget restraints for an individual producer are less restrictive.

Summary of Alternative Distribution Methods

The long-run impact of all three distribution methods depends upon the effectiveness with which the food is programmed to cause a permanent shift in production. In the case of grants, the only chance for increased production comes from the lasting nutritional effect which the food might have on the recipients. It is unlikely that improving adult diets for a short period has much lasting effect on productivity, but other situations such as providing improved diets to pregnant or nursing mothers in order to improve nutrition of the children might have a lasting effect. "...There is strong evidence to show that some of the effects of malnutrition may persist through adult life" (33, p. 12). Likewise, studies have shown that adequate diets for school children

significantly increases their ability to learn. Providing grants for school feeding could have a lasting effect on the productivity of the labor force by contributing to a higher level of education and training. In all cases, the permanent effects of grants on productivity are long run in nature and do not play a role in the immediate impact on supply.

The permanent effect of food used to finance overhead investment, whether directly through wages-in-kind or indirectly through open-market sales to raise revenue for investment, is the impact which the investments have on production coefficients and the quality of resources available for production. This determines the extent to which supply will shift to the right and maintain a level of higher output even after food aid is discontinued.

The positive correlation between product price and output offers a potential for stimulating output and improving producer welfare. Hendrix indicates the significance of product prices in stimulating production and development in India with his statement that "...concessional import sources blinded GOI leaders to the slow growth of agriculture and to the need for...price signals as a basic essential of sustained agricultural progress" (44, p. 9). However, increases in product prices have a direct effect on consumer welfare. Agricultural prices have a unique significance because of the high percent which food represents in total consumption. If development is to improve consumer welfare, increasing the price of food as an isolated policy to expand supply conflicts directly. Of course, it is possible to subsidize producer prices to stimulate production while maintaining reasonably low prices for consumers and consumer welfare.

Another means of improving consumer welfare is through changes in the technical coefficients of production. Such changes are heavily dependent on the introduction of new technology. In the developing countries, modern technology may not be available in general, and certainly is not to a majority of the producers. At early stages of development, individuals and private institutions are often unwilling or incapable of carrying on research which leads to new technology. Many of the developing nations can short cut the process by importing technology from countries with similar conditions which have already taken large steps in the area of research and new technology. The new wheat varieties from Mexico and rice varieties from the Philippines are good examples of agricultural technology which can be adapted to many of the developing countries. In general, industrial technology is even easier to import than agricultural technology because attention does not have to be given to geographic or climatic conditions in most cases.

After generating technology, it is essential to get the information to the producers. Dissemination of the technology can be handled through a 'one shot' approach or can be used to build an extension system which is capable of continuously transmitting new information to producers. One of the most effective extension techniques for agriculture in the developing countries has been the use of decentralized test plots where results can actually be observed by the producers under local conditions. Ultimately, shifts in the technical coefficients of production result in a slow process of freeing both capital and labor from agriculture so that it can be utilized in industrial development.

Decision makers in the industrial firms would be expected to possess a higher level of education so that less basic techniques of disseminating technology would be effective.

Still other means of promoting production exist which are more indirect. Many of the indirect approaches serve to reduce the cost of producing and moving the product from producer to consumer. A few of the obvious include providing expanded and reliable credit, improved transportation networks and storage facilities, modernized marketing systems and facilities, research facilities, and technical education programs.

Each aspect of promoting domestic production under a policy of lowering consumer prices and maintaining producer welfare involves overhead investments or direct financing. Food aid embodies the potential to substitute for part or all of the capital input. Distribution of food aid commodities for consumption by producers can free domestic commodities for sale and increase real income level of producers. Sale of food aid commodities generates revenue which can be used to support product prices or subsidize factor costs. The use of food aid commodities to provide part or all of wages for work projects increases real income to consumers, but can also develop resources which increase technical coefficients in the production process and lowers per unit cost of production. Similarly, overhead investments in labor to develop storage, transportation, and marketing facilities can lower the cost of marketing domestic products so that a larger portion of the retail price can be realized by the farmer, or retail prices can be lowered for consumers without lowering the wholesale price to producers. Food aid

commodities can also be utilized to subsidize and promote production for the benefit of producers. However, the distribution methods used and the ultimate use of the food commodities are more critical in providing for long-term benefits to producers than in providing for consumer benefits. Stagnant or declining prices of commodities in the developing countries can imply improved consumer welfare as development occurs, and do not necessarily imply a worsening of the producer position provided that generation and adoption of new technology has been effective in expanding resource productivity, thereby lowering the cost structure to compensate for any decline in product price. Consequently, consumer welfare and producer welfare are not necessarily in direct conflict.

Appendix A

Repayment Terms on Food Aid Contracts and the Net Value of Aid

Extended loan contracts used to finance food aid imports obligate the recipient to reimburse the donor not only for the value of commodities received but for accumulated interest as well. As the length of the contract is extended and/or the interest rate increased, the magnitude of payments to service the debt increase proportionately. When a continuous flow of aid is financed in this manner, the cumulative value of the annual debt will exceed the value of the new aid at some time during the repayment period for all positive interest rates.

Consider an agreement to receive a constant amount of food aid (X) each year on credit terms with repayment beginning at the start of the second year. If the principal payment is a fixed amount per year over a period of N years, the amount of principal payment (P) due in year n can be written as a function n and N.

$$P_n = X\left(\frac{n-1}{N}\right) \qquad \text{for } n \leq N + 1 \qquad \text{A.1}$$

The interest payment (I) can be written as a function of the interest rate (r) and the sum of the interest on the balance of the loan for each previous year

$$I_n = r \sum_{k=2}^{n} X\left(1 - \frac{k-2}{N}\right) \qquad \text{for } n \leq N + 1 \qquad \text{A.2}$$

using k as an accounting variable. In any given period the total payment (C) on the debt retirement is equal to the sum of Equations A.1 and A.2.

$$C_n = X\left(\frac{n-1}{N}\right) + r \sum_{k=2}^{n} X \left(1 - \frac{k-2}{N}\right) \text{ for } n \leq N + 1 \qquad A.3$$

Since this repayment schedule provides for the loan from period one to be liquidated in period N + 1, both the principal and interest payment reach a maximum when n equals N + 1. Substituting in Equation 6.1, the maximum principal payment is equal to the magnitude of the annual food aid contract.

$$P_{max} = X\left(\frac{(N+1) - 1}{N}\right) = X\left(\frac{N}{N}\right) = X \qquad A.4$$

Likewise the maximum value for the interest payment is obtained by substituting N + 1 for n in the summation and solving Equation A.2

$$I_{max} = r \sum_{k=2}^{N+1} X \left(1 - \frac{k-2}{N}\right) = r\ (X)\left(\frac{N+1}{2}\right) \qquad A.5$$

Given that r and n are positive values, I_{max} is greater than zero so that the value of payment due is greater than the magnitude of the aid received in that period. The point at which the payment exceeds the new contract is defined where the total payment is equal to X. Rewriting Equation A.3 and setting it equal to X, provides a quadratic equation for the point where payments equal value of the new contract.

$$C_n = X\left(\frac{n-1}{N}\right) + r\ (X) \left[\frac{(n-1)\ (2N - n+2)}{2N}\right] = X \qquad A.6a$$

$$C_n = \frac{n-1}{N} + r \left[\frac{(n-1)\ (2N - n+2)}{2N}\right] = 1.0 \qquad A.6b$$

Solving for n in Equation A.7

$$-rn^2 + 2Nrn + 3rn + 2n - 2Nr - 2N - 2r - 2 = 0 \qquad \text{A.7}$$

by using the general quadratic equation formula

$$n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \text{A.8}$$

payments from the recipient country exceed the concessional imports at

$$n = \frac{-(2Nr+3r+2) \pm \sqrt{(2Nr+3r+2)^2 - 4(-r)(-2Nr-2N-2r-2)}}{2(-r)} \qquad \text{A.9}$$

In Figures A.1-A.3 three repayment schedules (10, 20, and 30 years) are compared using interest rates from zero to 10 percent. The grid bases for Figure A.1-A.3 represent combinations of time (0 to 36 years) and interest rates (0 to 10 percent). The vertical distance from each time and interest combinations to the suface of the three-dimensional figure indicates the net contribution of aid to the recipient's resources. If the distance from the base to the xero point on the vertical axis, the contribution is positive; if it is less, the contribution is negative. The time period until the net aid becomes negative and the maximum value of payments vary according to the length of the repayment period and the interest rate. As the length of the repayment schedule increases, the maximum value of payments increase as total interest cost rise.. Likewise, higher interest rates are positively correlated with higher payments. Using an example of 4 percent interest on a continuous flow of aid over a 20 year period, annual payments to retire the long-term loan equal the annual aid received in about 13.5 years.

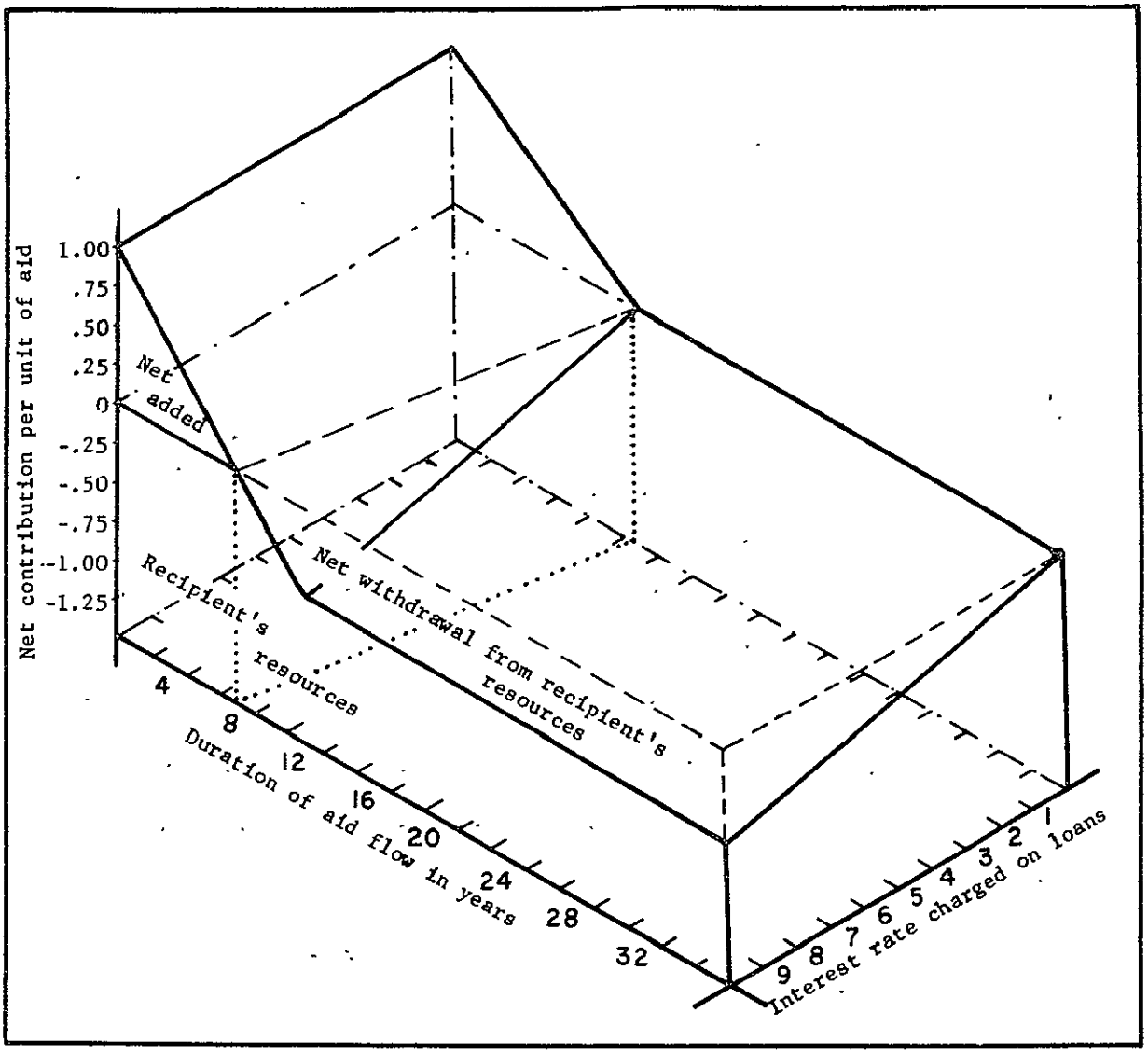

Figure A.1. Effect of aid flow duration and interest rates on recipient's net resource position after loan servicing (10 year repayment schedule).

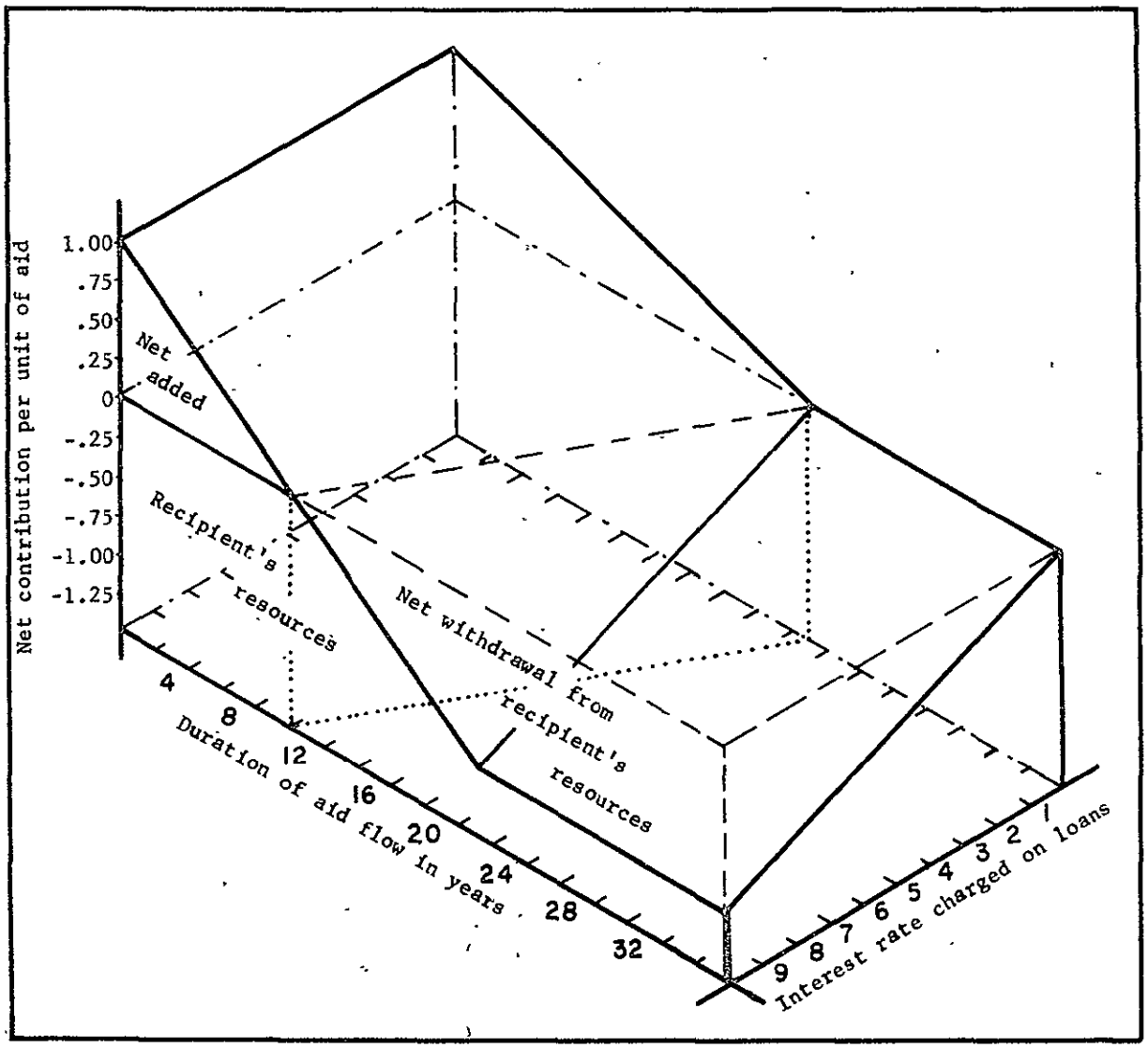

Figure A.2. Effect of aid flow duration and interest rates on recipient's net resource position after loan servicing (20 year repayment schedule)

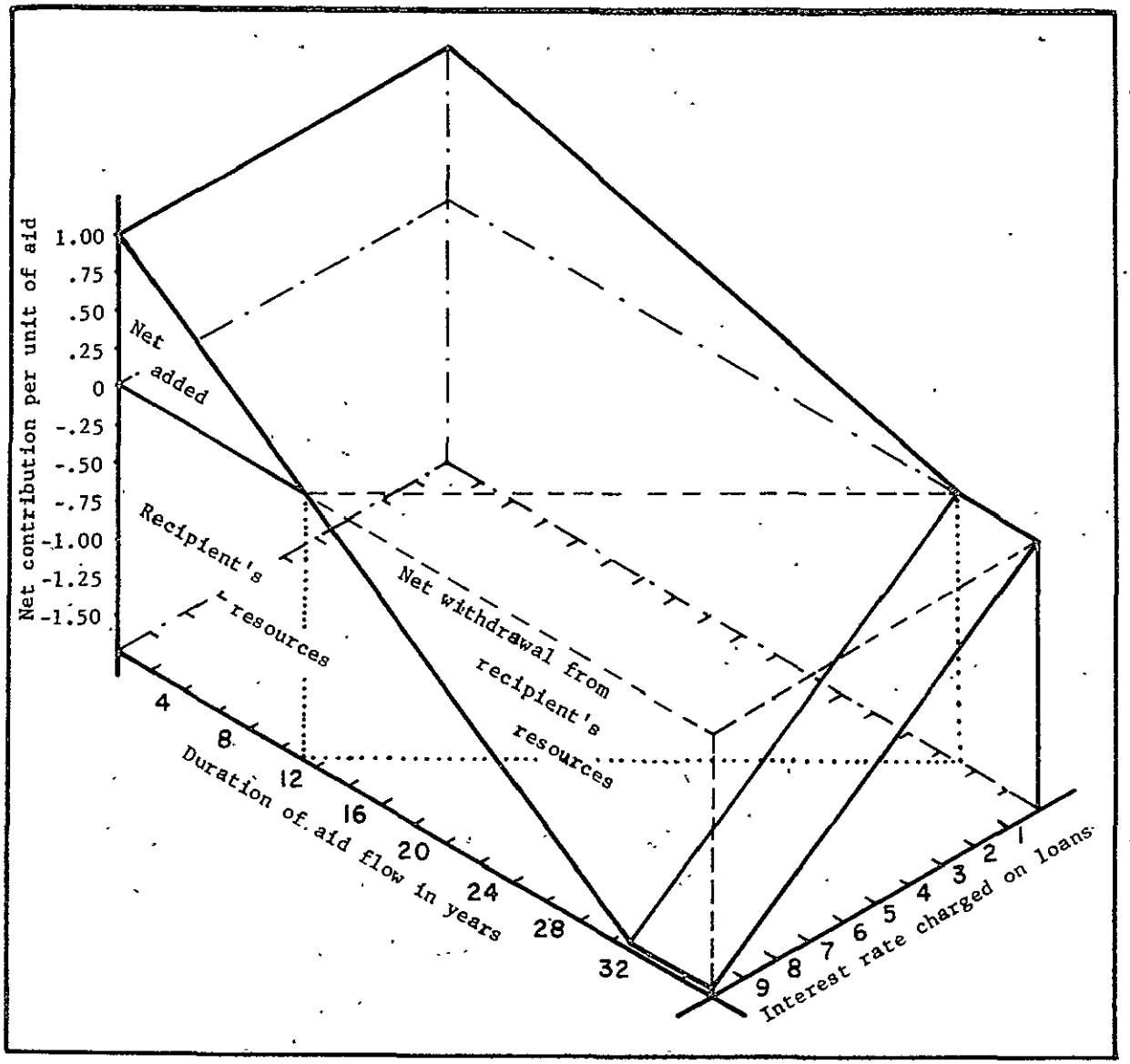

Figure A.3. Effect of aid flow duration and interest rates on recipient's net resource position after loan servicing (30 year repayment schedule)

Appendix B

A Review of Empirical Consumption Studies

The validity of Engel's Law with respect to food consumption patterns was verified by Houthakker in a cross-sectional study of personal expenditure patterns using international data (47, pp. 532-551). Although the Houthakker study reports total expenditure instead of income which is used in the strict formulation of the law, the results confirm the more rigorous formulation of Engel's Law.[1]

Using data published by Houthakker, an attempt was made in this study to develop an international Engel Curve for food. Three functional forms were considered: (a) the percent of budget spent for food on total expenditures, (b) the percent of budget spent for food on the log of total expenditures, and (c) the log of percent of budget spent for food on the log of total expenditures.[2] The semilog function, displayed in Figure B.1

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[1] Total expenditure differs from disposable income by the amount of savings and hoarding. Since income elasticities are normally smaller than expenditure elasticities, formulation of the test with income would only further emphasize the results obtained from using expenditures for the associated income levels.

[2] Regression of the percent of budget spent for food on total expenditure directly fits a linear relationship with a constant slope which implies a constant change in food consumption with respect to a change in expenditure (i.e., constant marginal propensity to consume food) and assumes that the coefficient of elasticity tends toward unity as income increases indefinitely. The linear form is inconsistent with consumer behavior by precluding the asymptotic approach to a plateau of maximum consumption. Regression of the log of the percent of budget spent for food on the log of total expenditure fits a double-log relationship which implies constant elasticity. The double-log form is often rejected on the basis of empirical evidence denying constant elasticity of demand for food. This form is probably used more often than the functional form merits simply because the elasticity coefficient is determined directly as the regression coefficient. The double-log form is often satisfactory over a relatively narrow income range and particularly when food consumption is expressed in terms of expenditure rather than quantity (41, p. 2). The semilog function has neither the handicap of constant marginal propensity to consume nor constant elasticity and allows the elasticity to vary with level of expenditure.

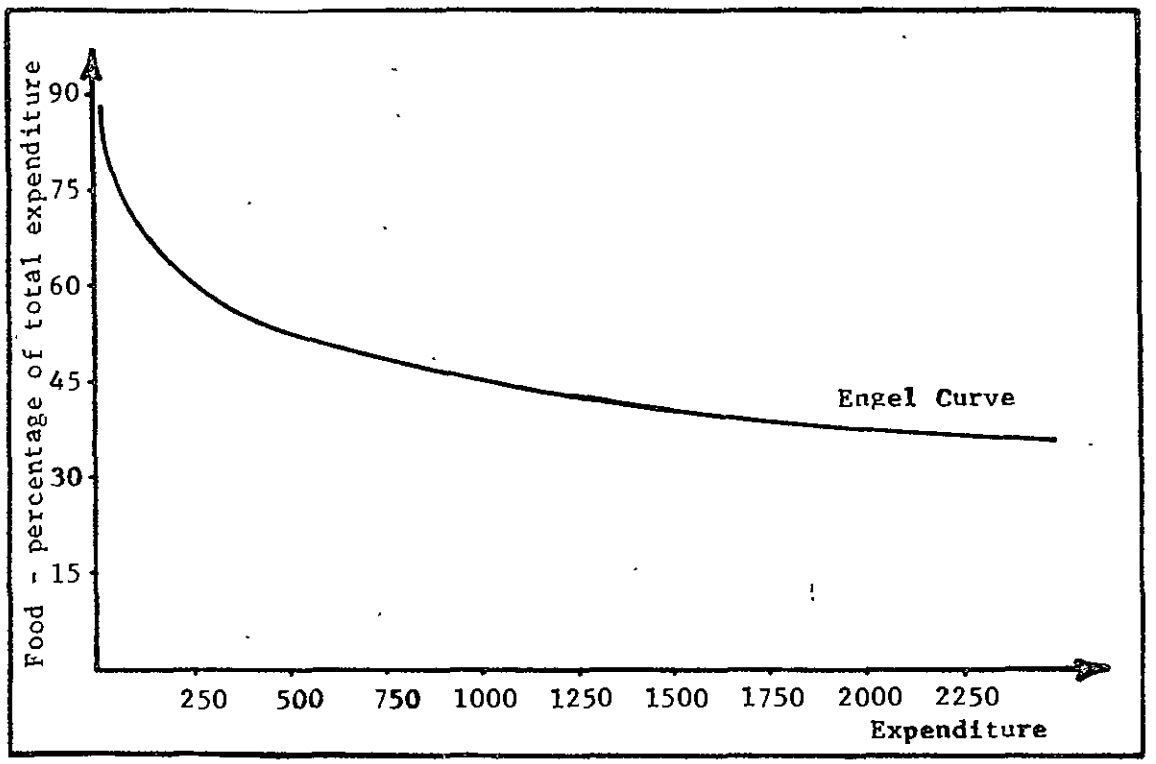

Figure B.1. Estimated international Engel Curve for food consumption based on a semilog function

resulted in the best fit.[1]

Values on the estimated Engel Curve range from a high of 100 percent at the very low budget levels down to approximately 35 percent at a total annual per capita expenditure of $2,500. At the low budget level the proportion spent on food decreases rapidly as expenditure increases up to about $750 where the slope of the function begins to stabilize.

Mellor argues that because tastes and preferences differ so widely between countries, comparisons of international data are not likely to be useful for detailed studies. However, he agrees that for broad

[1] R^2 for semi-log = 0.68, R^2 for linear = 0.63, and R^2 for double-log = 0.65.

aggregates of commodities, the international comparisons provide estimates surprisingly close to those from intracountry cross-sectional studies (64, p. 62). Similarly, Stevens has stated that "international comparisons of Engel Curve data provide more convincing evidence[1] on the general magnitude of the income elasticity of total food during development" (74, p. 18). With the high degree of aggregation used when classifying demand into two commodity groups, food and nonfood, the international data should provide reasonable estimates for food consumption at various income levels.

In a recent study of food consumption by the National Council of Applied Economic Research of New Delhi (50), the data indicate that the average yearly expenditure of an Indian consumer was $67.36 of which 52.5 percent was spent on food, 5.9 percent on clothing and 34.6 percent on other items. Expenditures ranged from less than Rs. 106.8 (about $22) to more than Rs. 672 (about $140) while food expenditures ranged from 65 percent down to 30 percent. Income elasticity of demand for wheat and rice were estimated at 0.58 and 0.47 respectively, and the elasticity for all cereals was estimated at 0.27 with maize, jowar, and small millet all having negative coefficients (50, p. 86).

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[1] Wold and Jureen state that budget study elasticities are not the same conceptually as time series elasticities, and that they should be smaller than the time series estimates (114, p. 56). If Wold and Jureen are correct, Stevens points out that budget study elasticities "could not be relied upon for estimates of the elasticity of food during development" (74, p. 17). For further discussion of the differences between time series and budget estimates, see Manderscheid (62).

Table B.1. Average per capita expenditure per month and year[a]

Commodity group	Per month (Rs.)	Per year (Rs.)	($)[b]	Percent of expenditure
Food	14.11	169.32	35.39	52.5
Fuel and light	1.58	18.96	3.96	5.9
Clothing	1.88	22.56	4.71	7.0
Other	9.29	111.48	23.30	34.6
Total	26.86	322.32	67.36	100.0

[a]Source: (50, p. 49).

[b]Official exchange rate for period covered by the study, 1964 and 1965, averaged 4.785 Rs./$ (52, p. 162).

In a similar study of food consumption in Korea for 1964-1967, income elasticity for grain was estimated at 0.55 and for all food at 0.54 (67, p. 77). Total per capita expenditure in the Korean study ranged from about $58 up to about $125 with the average being $80. The range on percent of expenditure for food was from 79 down to about 54 with an average of 65.6 percent.

In summarizing several studies of elasticity by F.A.O., Goreux estimates the income elasticity of food demand to be 0.85 at an annual per capita income of $50 and 0.25 at $1,500 (41, p. 6). For selected commodities his estimates are much higher at low income levels; Milk and milk products reach 2.2 and sugar reaches 1.5 at $50. Coale and Hoover cite Palvia as estimating the elasticity of demand for food at 0.8 in India for the period up to 1971 (19, p. 125). In an analysis

Table B.2. Monthly per capita food expenditure in India[a]

Income class (Rs.)	Total expenditure (Rs.)	Total food (Rs.)	Total food ($)[b]	Food percent expenditure
Under 8.9	11.57	7.49	1.57	64.8
9.0 - 11.9	14.64	9.02	1.89	61.6
12.0 - 13.9	18.52	10.37	2.17	56.0
14.0 - 15.9	18.08	10.98	2.29	60.8
16.0 - 18.9	24.55	13.52	2.83	55.1
19.0 - 21.9	22.45	12.77	2.67	56.9
22.0 - 24.9	29.50	16.07	3.36	54.6
25.0 - 28.9	_[c]	_[c]	_[c]	_[c]
29.0 - 34.9	33.80	15.96	3.34	47.3
35.0 - 43.9	37.01	17.91	3.74	48.4
44.0 - 55.9	51.30	23.49	4.91	45.8
Over 56.0	99.84	29.77	6.22	29.8
Average	26.86	14.11	2.95	52.2

[a]Source: (50, pp. 118-119).

[b]Official exchange rate = 4.785 Rs./$U.S. (52, p. 162).

[c]Data inconsistent due to reporting of unusual wedding expenditures.

of international data from 35 countries, Stevens estimated the elasticity at about 0.8 at $50 and about 0.6 at $1,000. In a similar analysis of data from 13 different countries, Stevens obtained estimates of 0.8 and

Table B.3. Food expenditure in Korea by household[a]

Income class (in 1,000 Won)	No. per household	Total expenditure (Won)[b]	Total food (Won)	Total food ($)[c]	Food percent expenditure
Under 72	4.2	60.767	48,220	189.10	79.3
72 - 96	5.3	85,022	63,810	250.02	75.0
96 - 120	5.6	107,235	76,642	300.56	71.5
120 - 144	6.5	132,528	87,350	342.55	65.0
144 - 168	7.3	156.193	96,677	383.05	62.6
168 - 192	6.9	180,221	106,395	417.24	59.0
Over 192	7.9	249,100	133,916	525.16	53.8
Average	6.0	123,934	81,307	318.85	65.6

[a]Source: (67, p. 81).

[b]Unit is 1964 Won.

[c]Official exchange rate 255 Won/$U.S. (52, p. 196).

0.56 at low ($75) and high ($600) income levels respectively (74, p. 19). Analyzing data published in a study by Kuznets, Stevens estimated the elasticity coefficient at 0.75 with a double-log function (74, p. 21 and 59, p. 24). Using a double-log function to analyze data from a study by Brown, Stevens estimated the elasticity coefficient at 0.73 (74, p. 21 and 15, pp. 42-44). Mellor suggests that the appropriate

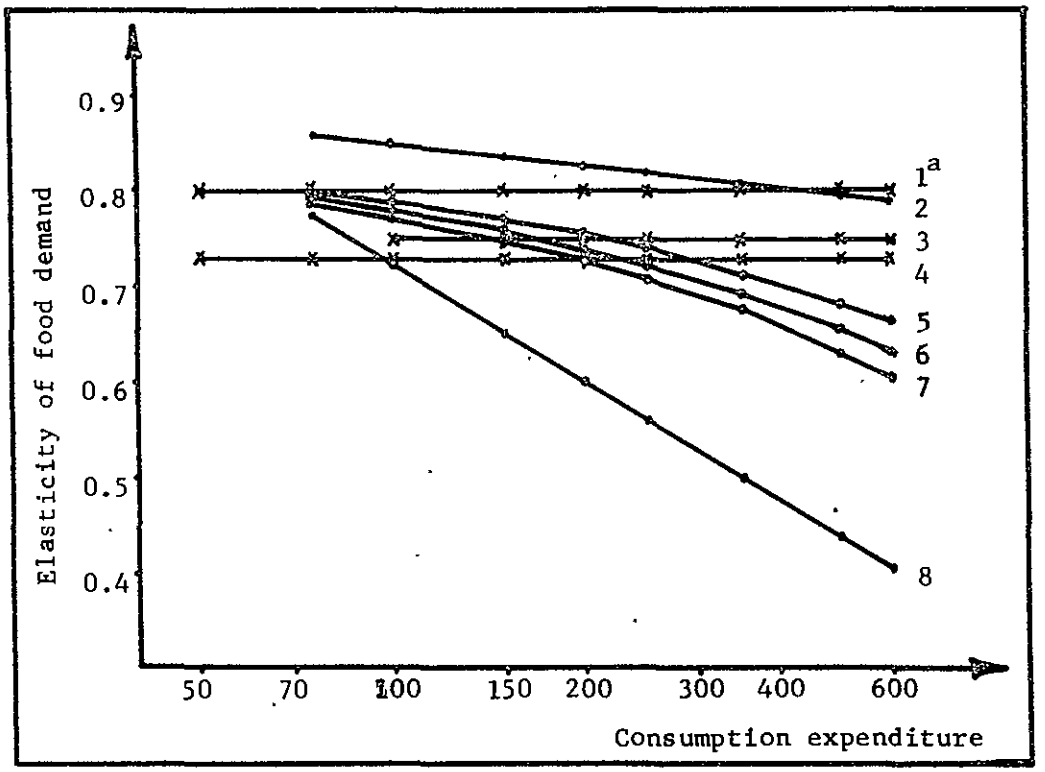

Figure B.2. Income elasticity estimates

[a]Source: 1--Palvia by Coale and Hoover (19), 2--Houthakker (47); 3--Kuznets (59); 4--Brown (15); 5--Stevens with 35 countries (74); 6--Stevens with 13 countries (74); 7--Pak and Han (67), and 8--Goreux (41).

elasticities for developing countries range from 0.9 at low income levels down to 0.5 at high income levels (64, p. 78). Elsewhere, Johnston and Mellor estimate that the elasticity is 0.6 or higher in developing countries (53, p. 339).

Results of these studies are summarized in Figure 4 by plotting the resulting elasticity estimates against consumption expenditure on a semilog scale.[1] Over the range from $75 to $600 the estimates are

[1]Results of the Indian study were observed to be unusually low estimates compared to the other studies and omitted. The low estimates may be attributed to the collection of data through budget studies which previously have been identified as tending to provide low estimates.

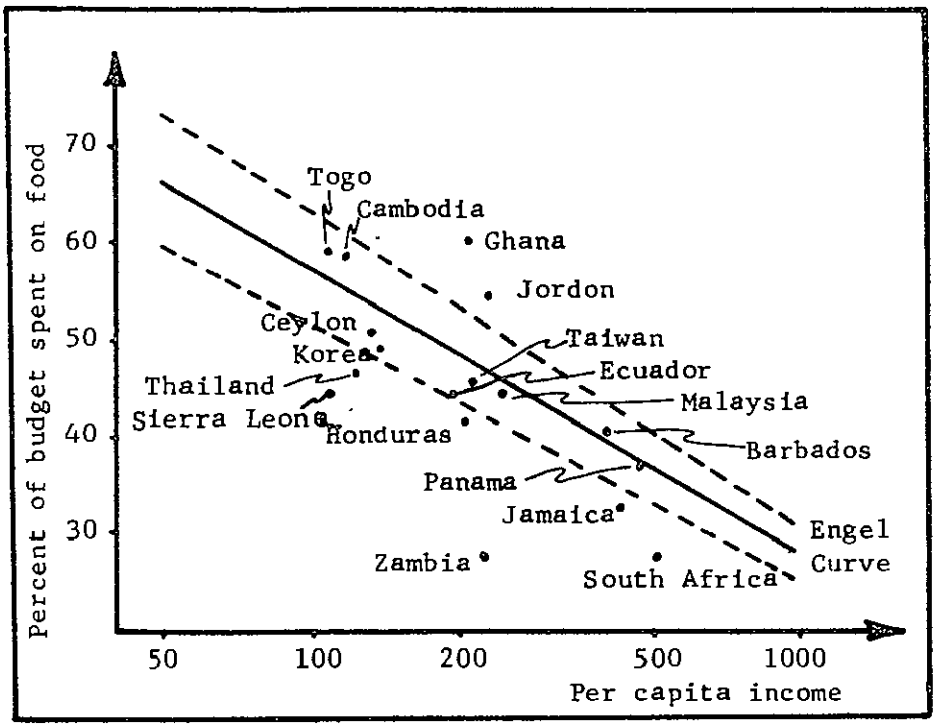

Figure B.3. International comparison of proportion of consumer budget spent on food (77 and 78).

bounded by data from Houthakker at the upper limit and from Goreux at the lower limit. At the low income levels, below $100, the estimates are quite close with the spread increasing at high income levels.

Relatively speaking, comprehensive estimates of the proportion which food represents of total consumer expenditures are quite limited. Of the 101 countries of the world for which the United Nations has estimated per capita income under $600 (78, pp. 48-53), they have food consumption estimates for only 17 (77). The plot of the 17 country estimates in Figure 5 with the Engel Curve estimated by Stevens[1] indicates that the small sample is not sufficient to improve on earlier estimates of the Engel Curve. Only half of the countries fall within the area outlined by the broken lines identifying points which are 10 percent above or below the estimated

[1]Stevens' estimated Engel Curve is F/E = 116.83 - 29.34 log E.

Engel Curve at each income level.

Appendix C

Income Level as a Factor in Derived Demand for Food Aid

The use of food aid to finance development investments gives rise to increased income directly through the income multiplier effect on investment expenditures and through the increase in output. A major portion of expenditures to develop capital resources are made for wages and domestic goods or devices which also embody a return to labor. Eventually the expenditures reach consumers as wages, which are in turn used for taxes, savings, and consumption. Determination of the rate at which private consumption will generate demand for food or other goods and services is directly a function of the stage of economic development and associated consumption patterns.

Considering three stages of development as denoted by annual per capita income levels of $75, $250, and $450, the variation in impact on demand can be examined.

Low income impact

Consider a development project which requires 70 percent of expenditure for labor, 20 percent for domestic goods and services, and 10 percent for imports. Directing the analysis first to countries with low ($75) incomes, part of the income received from wages will be saved, part will be used to pay taxes, and part will be used to purchase consumer goods. Most of the small portion of demand will be for imported consumer goods. Ezekiel estimates that at the margin savings equal about 9 percent of additional income (34, p. 9).

Deducting the 26 percent for savings (6.3 units), taxes (6.3 units), and imports (5.6 units), about 51.8 units of the 70 units paid for wages will be left to purchase domestic goods and services. On the basis of the studies summarized in Appendix B, low income consumers are estimated to have an income elasticity of demand for food of approximately 0.8. At $75 the average propensity to consume food was estimated at 0.55 for the India data, 0.62 for the U.S.D.A. study, 0.73 by the Houthakker data, and 0.78 with Korean data for a mean value of about 0.67 to 0.70. In combination an estimated elasticity of 0.8 and an average propensity to consume food of 0.67 to 0.70 imply a marginal propensity to consume food of about 0.55.[1] If 55 percent of the increase in income after savings, taxes, and imports is spent on food, the 70 units of investment used for wages will generate a demand for 28.5 units of food. Part of the food price represents marketing costs, however, so that only part of the 28.5 units represent increased demand for actual food commodities. Ezekiel estimates that the marketing costs for food are in the neighborhood of 15 percent in rural areas where food is sold at retail in about the same form it comes from the farmer (34, p. 9). Deducting the 15 percent which represents domestic services, the actual food demand would equal about 24.2 units. Consequently, if surplus commodities could be matched with the native diet, 24.2 units of food could be supplied directly to the workers as wages-in-kind or indirectly through a price controlled shop without affecting aggregate demand for or supply of domestic

[1] Since elasticity is equal to marginal propensity to consume divided by average propensity to consume, it follows that marginal propensity to consume is equal to average propensity to consume times elasticity.

food. At this level, food aid could only be used to finance one fourth of the cost of the project. If in contrast, 100 units of food were sold on the market and the income used to finance the project, a net increase in demand of 24 units implies that 76 units of the food would replace demand for domestic commodities. Before drawing a conclusion, it is necessary to consider what happens to the other 30 units of expenditure (20 for goods and services, and 10 for imports).

The 10 units which are used to import materials and equipment are paid to the exporting country and thus leave the economy of the recipinet country. The remaining 20 units are paid to domestic producers for goods and services. If there is excess capacity for supplying nonfood goods and services, a larger quantity can be sold at the same price. If supply is limited, the price will be bid up. In either case domestic producers receive additional income in the amount of 20 units.

Again, part of the additional income will be saved, part will be used to pay taxes, and part will be used to purchase consumer goods or additional raw materials for future production. Deducting the 26 percent for savings (1.8 units), taxes (1.8 units), and imports (1.6 units), 14.8 units are left as disposable income to be spent on domestic consumer goods.

With a marginal propensity to consume food of 0.55, 8.1 units will be spent for food. Deducting the 15 percent for marketing services, 6.9 units will represent additional demand for food and the remaining 1.2 units for services. Adding the demand generated from the direct purchases of domestic goods and services to the demand generated from

wages, the first round[1] increase in demand would be 31.3 units of food and 35.5 units of nonfood goods and services.

In the second round 26.2 of the 35.5 units of income to domestic producers will be available as disposable income after deducting savings (3.2), taxes (3.2) and imports (2.8). 14.1 units will be spent for food and 11.8 units for nonfood. Deducting the marketing costs on food, 12.3 units of food will be demanded in the second round and 14.0 units of nonfood and services. Adding the first round to the second round brings the total food demand generated by the project to 43.4 units.

Expanding the analysis through ten rounds exhausts the multiplier effect of spending and respending with the assumed coefficients. Theoretically the total increase in income reaches 148.5 units and derived demand for food reaches 51.4 units as the result of the original investment of 100 units.[2] Under an assumption of four months for the income

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[1] One round is defined as the lag between receipt of income and its final disposal. The Ezekiel study assumes a lag of four months so that three rounds of spending occur per year (34, p. 55). Srivastava cites Khusro as considering a lag of three months realistic, resulting in four rounds per year (73, p. 165). Specification of the income-expenditure lag will not affect the estimate of derived income or demand for food, but it will affect the magnitude of the estimates per unit of time.

[2] In the multiplier analysis, total expansion of the spending and respending is limited by the "leakage" out of consumers' hands. The usual leakage results from savings, taxes and imports. The income multiplier is defined as $\frac{1}{s + t + i}$ where s, t, and i represent marginal savings, taxation, and import rates. The larger the sum of these three variables, the greater the leakage during each round and consequently the lower the multiplier effect. Using 26 percent as the estimated sum of s, t, and i implies a Keynesian investment-income multiplier of 3.85 which should produce 385 units of income from the 100 units which were originally invested. However, at each round it was implicitly assumed that the food demand would be satisfied with surplus food aid which also represents an import and further reduces the income to domestic producers at each round.

Table C.1. Aggregate impact of 100 units investment on selected economic variables in low income countries[a]

Round	Gross domestic income	Savings	Taxes	Imports	Disposable income	Derived demand: Retail food	Derived demand: Wholesale food	Derived demand: Goods and services
1. (wages)[b]	70.00	6.30	6.30	5.60	51.80	28.49	24.22	27.58
(other)[c]	20.00	1.80	1.80	1.60	14.80	8.14	6.92	7.88
2.	35.46	.19	3.19	2.84	26.24	14.43	12.27	13.97
3.	13.97	1.26	1.26	1.12	10.34	5.69	4.83	5.50
4.	5.50	.50	.50	.44	4.07	2.23	1.90	2.17
5.	2.17	.20	.20	.17	1.61	.88	.75	.86
6.	.86	.08	.08	.07	.64	.35	.30	.34
7.	.34	.03	.03	.03	.25	.14	.12	.13
8.	.13	.01	.01	.01	.10	.05	.04	.05
9.	.05	0.00	0.00	0.00	.04	.02	.02	.02
10.	.02	0.00	0.00	0.00	.01	.01	.01	0.00
Total	148.50	13.37	13.37	11.88	109.90	60.43	51.38	58.50

[a]Statistics: Savings = 9%, taxes = 9%, imports = 8%, mpc-food = 0.55, marketing costs = 15%.

[b]First round impact of project expenditures directly for wages.

[c]First round impact of project expenditures for domestic goods and services.

expenditure lag, 94 percent of the increase in income and food demand would occur during the first year. Under an alternative assumption of three months for the income-expenditure lag, over 97.5 percent of the increase occurs during the first year. In either case the increases in income and demand for food occur very rapidly in the low income countries due to the high proportion of the budget which is allocated to food demand and consequently the rapid leakage from the economy when food aid is used to meet increased demands. Under these conditions about 50 units or half of the original investment could be financed in the first year through the use of food aid without affecting the domestic market prices.

In addition to the multiplier effect on income and food demand, the project would generate 12.5 to 13.0 units of savings and a similar amount of tax revenue in the first 12 to 15 months. Presumably the increase in savings will be channeled into investment and will increase productivity in future periods. Using a multiplier of the magnitude determined above, 1.39 for three rounds, the 13 units of savings would generate 18 units of additional income in the second year and another 6.2 units of demand for food, bringing the total food demand for two years (six rounds) to 57.4 units. To balance supply with demand, 48.2 units of the surplus food should be supplied in the first year and the remaining 9.2 units supplied in the second.

Formalizing the calculation in notation form, disposable income (DI) is equal to gross income (GI) times the difference between one and the sum of marginal tax (T), savings (S), and import (M) rate.

$$DI = GI \left[1.0 - (T + S + M)\right] \qquad C.1$$

The retail demand for food (RF) is equal to disposable income times the marginal propensity to consume food (MPC) out of income. Wholesale

$$RF = GI(MPC) \qquad C.2$$

demand for food (WF) is equal to retail demand for food minus marketing costs or retail times the difference between one and the percent marketing margin represents of the retail price (MC).

$$WF = RF\ (1.0 - MC) \qquad C.3$$

Collectively, the wholesale demand for food can be redefined directly as

$$WF = GI \left[1.0 - (T + S + M)\right] \left[MPC\right] \left[1.0 - MC\right] \qquad C.4$$

where only the variables T, S, M, MPC and MC must be specified to adapt the calculations to a specific economy. For the multiperiod total impact which considers the income multiplier, the first period income must be expanded by a factor of one divided by the sum of taxes, savings, and imports. Since food aid is an import the appropriate factor is the reciprocal of the quantity $(T + S + M) + \left[1.0 - (T + S + M)\right]$ (MPC) $(1.0 - MC)$, and the total derived demand for wholesale food can be calculated directly as

$$WF = \frac{GI\ (1.0 - T - S - M)\ \ (MPC)\ \ (1.0 - MC)}{(T + S + M) + (1.0 - T - S - M)\ \ (MPC)\ \ (1.0 - MC)} \qquad C.5$$

by substituting specific values for the five parameters and the amount of gross expenditre for domestic goods and services.

Medium income impact

Consider an investment project in a medium income country which requires 70 percent labor, 20 percent domestic goods and services, and 10

percent imports. Based on the consumption studies cited in Appendix B, medium income consumers are estimated to have an income elasticity of demand for food of approximately 0.73. The Stevens study provides a median value for average propensity to consume food of 0.465 at $250 (74, p. 19), implying a marginal propensity to consume food of 0.34.

Seventy units of investment paid as wages to consumers with a marginal propensity to save of 0.09, a marginal taxation rate of 0.09, a marginal propensity to consume imports of 0.08, and a marginal propensity to consume food of 0.34 would generate 17.6 units of demand for retail food. As Ezekiel pointed out (34, p. 9), increases in the income level and associated food expenditure result in a larger percent of the food budget being spent on services. If the marketing costs are increased to 20 percent, the derived demand for wholesale food will be reduced to 14.1 units. The balance of the 51.8 units of disposable income, 37.7 units, will be spent on domestic goods and services.

The additional 20 units of the investment which are used to purchase local equipment, supplies, and services will generate another 4.0 units of demand for food at wholesale and 18.0 units of demand for domestic goods and services. Under the assumed parameter estimates for the medium income consumers, first round impact of 100 units of investment would generate a demand for only 18.1 units of food. Tracing the 48.5 units of income for domestic producers through the second round adds 9.8 units of food demand. At the end of one year (three rounds) the multiplier effect would generate 164.6 units of domestic income and 33.1 units of food demand. At the end of two years, the derived income is up to 190.3

Table C.2 Aggregate impact of 100 units of investment on selected economic variables in medium income countries[a]

Round	Gross domestic income	Savings	Taxes	Imports	Disposable income	Derived demand: Retail food	Derived demand: Wholesale food	Derived demand: Goods and services
1. (wages)[b]	70.00	6.30	6.30	5.60	51.80	17.61	14.09	37.71
(other)[c]	20.00	1.80	1.80	1.60	14.80	5.03	4.03	10.77
2.	48.48	4.36	4.36	3.88	35.88	12.20	9.76	26.12
3.	26.12	2.35	2.35	2.09	19.33	6.57	5.26	14.07
4.	14.07	1.27	1.27	1.13	10.41	3.54	2.83	7.58
5.	7.58	.68	.68	.61	5.61	1.91	1.53	4.08
6.	4.08	.37	.37	.33	3.02	1.03	.82	2.20
7.	2.20	.20	.20	.18	1.63	.55	.44	1.19
8.	1.19	.11	.11	.10	.88	.30	.24	.64
9.	.64	.06	.06	.05	.47	.16	.13	.34
10.	.34	.03	.03	.03	.25	.08	.07	.18
Total	194.70	17.53	17.53	15.60	144.08	48.98	39.20	104.88

[a] Statistics: Savings = 9%, taxes = 9%, imports = 8%, mpc-food = .34, marketing costs = 20%.

[b] First round impact of project expenditures directly for wages.

[c] First round impact of project expenditures for domestic goods and services.

units and additional food demand up to 38.3 units. After 10 rounds the total income generated is 194.7 units of which 39.2 is converted to food demand. Therefore, 84.5 percent of the total impact is generated in the first year and about 97.0 percent is generated before the end of the second year.

If the savings from the first year are assumed to be reinvested in the second year and subject to the multiplier of about 1.64, the 14.8 units of savings would generate about 24 units of income and 4.8 units of demand for food. Taking expenditures for wages, local supplies, and investment of savings all into consideration, it is estimated that about 43 percent of development investments in the medium income countries could be financed with food aid without affecting domestic food prices, as compared to 57 to 58 percent in the low income countries.

High income impact

For comparison with the low and medium income countries, a project requiring the same input mix is evaluated for the high income countries. On the basis of the consumption studies cited in Appendix B, the high income consumers are estimated to have an income elasticity of demand for food of 0.66. Using 0.39 from the U.S.D.A. study (74, p. 19) as an estimates of average propensity to consume, a marginal propensity to consume food of 0.21 is implied. Deducting the 26 percent for savings, taxes, and imports, leaves 51.8 units of 70 units paid for wages, available to purchase consumer goods. With a marginal propensity to consume food of 0.26, 13.47 units will be spent on food. Raising the marketing cost to 25 percent to reflect additional services, the net demand for wholesale food would

Table C.3 Aggregate impact of 100 units of investment on selected economic variables in high income countries[a]

Round	Gross domestic income	Savings	Taxes	Imports	Disposable income	Derived demand: Retail food	Derived demand: Wholesale food	Derived demand: Goods and services
1. (wages)[b]	70.00	6.30	6.30	5.60	51.80	13.47	10.10	41.70
(other)[c]	20.00	1.80	1.80	1.60	14.80	3.85	2.89	11.91
2.	53.61	4.82	4.82	4.29	39.67	10.31	7.74	31.94
3.	31.94	2.87	2.87	2.56	23.64	6.15	4.61	19.03
4.	19.03	1.71	1.71	1.52	14.08	3.66	2.75	11.34
5.	11.34	1.02	1.02	.91	8.39	2.18	1.64	6.76
6.	6.76	.61	.61	.54	5.00	1.30	.98	4.03
7.	4.03	.36	.36	.32	2.98	.77	.58	2.40
8.	2.40	.22	.22	.19	1.78	.46	.35	1.43
9.	1.43	.13	.13	.11	1.06	.28	.21	.85
10.	.85	.08	.08	.07	.63	.16	.12	.51
Total	221.39	19.92	19.92	17.71	163.83	42.59	31.97	131.90

[a]Statistics: Savings = 9%, taxes = 9%, imports = 8%, mcp-food = 0.26, market costs = 25%.

[b]First round impact of project expenditures directly for wages.

[c]First round impact of project expenditures for domestic goods and services.

be 10.1 units. Similarly the 20 units used to purchase domestic goods and services would generate 2.89 units of demand for food at wholesale. Traced through 10 rounds of spending, the 100 units of investment is estimated to generate 221 units of income and almost 32 units of demand for food. Assuming that the savings from the first round is reinvested in the second round, the 14.8 units would generate 26.0 units of income and 3.7 units of food demand using the first year income multiplier of 1.76. In the third round the investment from first round savings is estimated to generate another 5.4 units of income and 0.8 units of demand for food. Total derived food demand for the high income group is, therefore, estimated to be 36.5 units or 36.5 percent of the original investment over 3 years with the distribution by year being 25.3, 9.1, and 2.1 percent respectively.

Alternative resource requirement for project investments

As an alternative to the labor intensive projects which required inputs in a 70:20:10 ratio, the impact of a less labor intensive project is analyzed. Consider a project which requires 50 percent of the input as labor, 35 percent as domestic goods and services, and 15 percent as imports. The previous assumption of marginal savings, taxation, and import demand are maintained at 9, 9, and 8 percent respectively. The switch from labor inputs to increased use of domestic goods and services and foreign imports resulted in an estimated ten round multiplier of about 1.40 for the low income group compared to the previous multiplier of 1.48.[1] At a marginal propensity to import of

[1] It can be shown that the decline of 8 percent results exclusively from the increase in imports needed to support the initial investment rather than from the shift in use of labor to domestic goods and services.

8 percent, the derived demand for imports is estimated to decline by about one half of 1 percent while the total demand for imports would increase by roughly 3 percent. Similarly, domestic savings and tax revenue from the investment would decline by less than 1 percent when compared to the labor intensive project in the earlier case. The direct demand for food at wholesale and domestic goods and services are each estimated to decline by about 3 percent with food decreasing to 48.5 percent, and goods

Table C.4. Income multiplier under resource input of 50:35:15

Round	Income generated by income group		
	Low	Medium	High
1	0.8500	0.8500	0.8500
2	0.3349	0.4579	0.5063
3	0.1320	0.2567	0.3016
4	0.0520	0.1329	0.1797
5	0.0205	0.0716	0.1070
6	0.0081	0.0386	0.0637
7	0.0032	0.0208	0.0379
8	0.0013	0.0112	0.0226
9	0.0005	0.0060	0.0135
10	0.0002	1.8389	2.0903
Total	1.4027	1.8389	2.0903

services to 55.0 percent.[1]

[1]The aggregate demand for food and other domestic goods and services can be calculated directly from the income multiplier. Wholesale food demand represents 34.6 percent (i.e., 74 percent x .55 x 85 percent) of income and goods and services 39.4 percent (i.e., 74 percent - 34.6 percent).

For the medium income group, the shift in resource inputs is estimated to reduce the income multiplier from 1.95 to 1.84 for a reduction of 10 percent.[1] A reduction of 10 percent in income combined with a marginal propensity to demand imports of 8 percent reduces derived demand for imports by less than 1 percent. However, the additional import demand for the initial investment increases the total import demand by a net of roughly 4 percent. Likewise, savings and tax revenue would each decrease by just under 1 percent when compared with the 70:20:10 case. Direct derived demand for goods and services would decline by almost 5.5 percent.[2]

For the high income group, the income multiplier is estimated to decrease by about 12 percent to 2.09 from 2.21.[3] The 12 percent reduction in generated income would reduce derived imports by 1 percent so net demand for imports would increase by 4 percent when considering initial project investment. Savings and tax revenue would each decrease by about 1.1 percent. Direct derived demand for wholesale food again decreases by roughly 2 percent[4] while derived demand for goods and services decrease by a little over 7 percent.

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[1]The theoretical change in the multiplier is equal to $\frac{5}{26 + 20.1}$ or about 10 percent.

[2]The factor for direct calculations of aggregate demand for food from total income is euqal to 20.1 percent (i.e., 74 percent x .34 x 80 percent).

[3]The division for the multiplier is 30.4 (i.e., 26 + 14.4).

[4]The factor for derived food demand is 14.4 (i.e., 74 percent x .26 x 75 percent).

Alternative parameter estimates for savings and taxation

For the purpose of analyzing the impact of various parameter estimates on the demand for food aid and related economic variables, consider the possibility that 9 percent is too high for an estimate of marginal savings or taxation. To standardize comparisons with earlier calculations, a project requiring 70 percent of the resource input as labor, 20 percent as domestic goods and services, and 10 percent as imports is used as the basic analytical unit, but savings is calculated using a marginal propensity to save of 7 percent.

A lower savings or tax rate implies less leakage from the economy and consequently a higher income multiplier. A 2 percent decrease in savings or tax rate with the parameters of the low income group results in a 2.4 to 3.0 percent increase in the total income generated from the project directly. However, because of the decrease in tax or saving rate, the net effect on either tax revenue or savings would be a decrease of about 2.5 to 3.0 percent. If it is assumed as in the earlier analysis that savings from the first year are reinvested the second year, a

Table C.5. Impact of 100 unit investment with 70:20:10 distribution and marginal tax or savings rate of 7 percent

Income group	Income multiplier	Savings or tax	Wholesale food
Low	1.512	10.6	53.7
Medium	2.009	14.1	41.5
High	2.302	16.1	34.1

decrease of 2.5 units[1] of savings would reduce total income generated from the project by 3.5 units, using a multiplier of 1.4 as before. Therefore, although the reduction in savings rate would increase income generated directly from the investment in a development project, the loss of future private investment from the savings more than offsets the direct gain. The magnitude of the savings coefficient would only be significant if the savings were not reinvested. In that case the lower the savings rate, the higher the income multiplier.

The same would be true for tax revenue. For the low income group, the rate of taxation has little impact on the aggregate multiplier as long as the government reinvests the tax revenue. If on the other hand the government uses the revenue for external debt servicing or other uses which remove it from the economy, a higher tax rate would lower the income multiplier by increasing the leakage.

For the medium income group, a 7 percent savings or tax rate, as opposed to a 9 percent tax rate, would increase the direct income multiplier by about 6.2 percent to 2.01. Savings on tax revenue would fall by 3.4 units so that income from reinvestment would fall by about 5.5 units. Under the parameters assumed for the medium income group, the lower savings or taxation rate would result in a slightly higher income multiplier when reinvestment is considered.

For the high income group, the lower tax or savings rate produces a multiplier which is about 8.8 units higher than with the 9 percent

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[1] Of the total reduction of savings, 2.5 units occur during the first three rounds or first year.

rate. Total savings on tax revenue would be 3.8 units lower, decreasing the income from reinvestment by about 6.5 to 7.0 units. The net effect, considering 1 round of reinvestment, would be about a 2 percent increase in income generated from the investment.

Appendix D

A Simplified Equilibrium Model to Evaluate Distribution Methods

Distribution of food aid in a recipient economy produces an exogeneous shift in supply. Depending on the distribution method and price relative to domestic prices, distribution of food aid also produces an income effect for consumers. With both supply and demand shifting, at unequal rates in most cases, the impact of food aid on prices and corresponding domestic production must be evaluated with an equilibrium model which provides for shifts in both the supply and demand schedules as well as movement along the schedules to adjust to a new equilibrium. For a simplified equilibrium model which will meet the above criterion, demand is specified as a function of price (P) and a coefficient (b) representing the impact of all other variables on demand; e is the price elasticity of demand.

$$Q_d = bP^e \qquad \text{D.1}$$

Similarly, supply is specified as a function of price and a coefficient (c) representing the impact of all other variables on supply;

$$Q_s = cP^{\epsilon} \qquad \text{D.2}$$

ϵ is the price elasticity of supply. The equilibrium price which will equate supply and demand is derived by setting the supply and demand

$$P_1 = b^{\xi}c^{-\xi} \qquad \text{D.3}$$

equations equal and solving for price.[1] Substituting Equation D.3 into either Equation D.2 or D.3 provides the equilibrium quantity where supply

$$Q_1 = b^{1+\xi e_c - \xi e} \qquad \text{D.4a}$$

or

$$Q_1 = b^{\xi e_c 1 - \xi e} \qquad \text{D.4b}$$

and demand are equal. The impact of a shift in supply and/or demand on the equilibrium price and quantity is derived by multiplying Equations D.1 and D.2 by shift factors and recalculating price and quantity.[2] Using Γ as the shift factor for demand and ψ as the shift factor for supply, the new equilibrium price is

$$P_2 = (\Gamma b)^{\xi} (\psi c)^{-\xi}, \qquad \text{D.5}$$

so the relationship between new and old price is

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[1] To simplify the manipulation of future equations, $-\xi$ is defined to equal $(e-\epsilon)^{-1}$.

[2] The multiplicative logrithmic form of supply and demand functions were used for ease of solution in the simplified model. Although food aid is additive along the two functions as a constant rather than multiplicative as a relative change, the two forms will not differ significantly in value around equilibrium. If K is defined as the quantity of food aid imported, and ψ is defined as 1.0 plus the fraction K divided by the eqiulibrium quantity of supply, $(cP^{\epsilon})\psi$ will not differ significantly from $cP^{\epsilon} + K$ for adjustments around equilibrium. At equilibrium $cP^{\epsilon}\psi$ will equal $cP^{\epsilon} + K$. At prices above equilibrium, $cP^{\epsilon}\psi$ is slightly greater than $cP^{\epsilon} + K$; below equilibrium $cP^{\epsilon}\psi$ is slightly less than $cP^{\epsilon} + K$. Similar logic applies to the demand function.

$$P_2 = (\Gamma^{\xi}\psi^{-\xi})\ P_1. \qquad \text{D.6}$$

The new equilibrium quantity is

$$Q_2 = (b\ \Gamma)^{1+\xi e}\ (c\psi)^{-\xi e} \qquad \text{D.7a}$$

or

$$Q_2 = (b\Gamma)^{\xi\epsilon}\ (c\psi)^{1-\xi\epsilon} \qquad \text{D.7b}$$

and the relationship between the new and old quantity is

$$Q_2 = (\Gamma^{1+\xi\epsilon}\ \psi^{-\xi e})\ Q_1 \qquad \text{D.8a}$$

or

$$Q_2 = (\Gamma^{\xi\epsilon}\ \psi^{1-\xi\epsilon})\ Q_1. \qquad \text{D.8b}$$

Grants and donations of food commodities

For analysis, assume that food aid grants which amount to 5 percent of the domestic supply at the previous equilibrium are provided to a group of low income consumers with marginal propensity to consume food at or near 1.0. With the magnitude of the horizontal shift in supply equal to 5 percent, ψ takes a value of 1.05. Assuming that the P.L. 480 commodities have a market value equal to the domestic commodities, the horizontal shift in the demand curve (Γ) resulting from a change in income is equal to 1.0 plus the marginal propensity to consume food times (ψ - 1.0).[1] With marginal propensity to consume equal to or near

[1] If P.L. 480 commodities are valued below similar domestic products, the income effect will be less than the shift in supply so that it would be appropriate to modify the definition of the demand shift by multiplying

(footnote continued on next page)

1.0 for this group,

$$\Gamma = 1.0 + (MPC_{food})\ (\psi) \qquad D.9$$

food grants would increase demand by an amount equal to the additional supply, and Γ would also be of the magnitude of 1.05. When Γ is equal to ψ there is no change in price because the new supply and demand are just equal at the old price.

Although food grants have traditionally been supplied to consumers at extremely low income levels, grant programs could be designed to reach consumers who already have some minimum level of income, for example the $75 per year used earlier in the discussion of consumption pattersn. For this group the marginal propensity to consume food was estimated at 0.55. Estimates of price elasticities are conspecuously absent from the development literature. The best estimates of reasonable values for price elasticities result from piecemeal data in the literature combined with known relationships which constitute consumer theory. Considerable reliance has been placed on the working assumption that the sum of the price elasticity, income elasticity, and cross-price elasticity is equal to zero (64, p. 71).[1] Mellor argues that at low income levels, price elasticity and income elasticity of demand for food will be very close in absolute value because, although the cross-price

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(Footnote continued from previous page) ψ by the ratio of P.L. 480 prices to domestic prices, redefining $\Gamma \approx 1.0 + MPC\ (\psi - 1.0)\ (P_{P.L.480}/P_{dom})$. Γ is derived from $\Gamma - 1.0 \approx MPC\ (\psi - 1.0)$ which implies $\Gamma = 1.0 + MPC\ (\psi - 1.0)$.

[1] The mathematical proof, as cited by Mellor, that the income elasticity is equal to the sum of the price and cross-price elasticities is provided by Wold in H. Wold and L. Jureen (114).

elasticity of food demand with nonfood demand will be very small, it is unlikely that it will be negative (64, p. 72). Consequently, price elasticity will be equal to or greater than income elasticity.

In two commodity cases, if food and nonfood commodities are not substitutes for the low income consumer, the cross-price elasticity would be zero or very close to zero, which implies a price elasticity equal in absolute value to the income elasticity. For the very low income consumer for whom food aid represents the major source of real income, the marginal and average propensities to consume food would probably approach 1.0, implying an income elasticity and consequently a price elasticity near unity.

At the other extreme of relatively high income level, Brandow estimated the price elasticity of demand for all food at -0.34, for the United States for the period 1955-1957 (13, p. 17). However, the per capita income on which Brandow's estimate is based is considerably above the high income example used for the discussion of developing nations in this study. It is more likely that an adjustment estimate of price elasticity appropriate for the consumer with an income of $450 should be of the magnitude -0.45 to -0.50. Mellor hypothesizes the price elasticity at low income levels, comparable to the $75 level in this study, is -0.85 to -0.90 (64, p. 72). On the basis that price elasticities fall and cross-price elasticities increase as income levels rise, -0.65 to -0.70 appears to be a reasonable estimate for price elasticity of the medium income consumer.

The second estimate necessary to evaluate the impact of P.L. 480 grants to consumers with incomes near $75 per capita is the responsiveness of producers to price change or price elasticity of supply. A wide range of estimates have been put forth in the literature. As an indicator of the range, the elasticity has been estimated at -0.33 for gram in India (58, p. 485) to 14.17 for corn in Thailand (7, p. 325).[1] Most of the short-run estimates summarized by Hexem fall between 0.02 and 0.62 for rice (7, pp. 290-293) and at about 0.1 for wheat (29, p. 588). The long-run estimates range from 0.06 to 3.12 for rice with the majority falling between 0.06 and 0.60 (7, pp. 290-293). Similar estimates for wheat fall within a range from 0.14 to 0.22 (58, p. 485). Data from the Witt and Eicher study indicate supply elasticity estimates of 1.9 for wheat in Israel and 1.3 for barley in Colombia (113). U.S. Bawa estimates the aggregate price elasticity of supply for agricultural products in India at approximately 1.2 (6). Although several estimates exceed unity, most of the estimates for general geographic regions are below 0.5. Recognizing that greater response is possible, 0.40 will be used as an estimate of price elasticity of supply for this analysis.

Using 0.40 as the supply elasticity and considering the case where food grants of P.L. 480 commodities constitute 5 percent of the pre-program supply, the coefficients of the equilibrium model are $\psi = 1.05$, $e = -0.9$, and $\varepsilon = 0.40$. Assuming marginal propensity to consume food is 0.55 for the consumers with annual income of $75 per capita, Γ has a value of 1.0275. From Equation 5.6 the new equilibrium price is 98.34

[1] Hexem, Roger W. Ames, Iowa. Supply elasticity estimates. Private communication. 1970.

percent of the old price, and from Equation 5.8 the new equilibrium demand is 104.3 percent of the previous level. Since a quantity equal to 5 percent of the previous supply is furnished as food grants from P.L. 480 imports, the quantity of domestic agricultural commodities demanded falls slightly to about 99.3 percent of the previous level. In combination, the decline in price and the slight decline in quantity demanded causes the agricultural producers to suffer approximately a 2.35 percent loss in income. The loss of the agricultural sector represents a gain to the nonagricultural sector in terms of increased demand for nonfood commodities.

Grant programs which provided food to the medium income consumers with an annual per capita income of $250 have an even greater effect on the market situation then with the lower income consumers. The marginal propensity to consume food was estimated at 0.34 for this group, and the price elasticity of demand was estimated at -0.70. Using 0.40 as the supply elasticity and adding food grants equal to 5 percent of the previous equilibrium supply, the coefficients of the model become $\psi = 1.05$, $\Gamma = 1.017$, $e = -0.70$, and $\varepsilon = 0.40$. From Equation D.6 the new equilibrium price decreases 2.84 percent and the quantity demanded increases by 3.8 percent. Subtracting out the 5 percent of final demand supplied as grants from P.L. 480 commodities, and adjusting for the lower price, the revenue effect on domestic producers would result in a loss of about 4.01 percent. Again the loss to the agricultural sector represents a gain for the nonagricultural sector through increased demand for nonfood items.

Similarly, programming food grants to high income consumers ($450) has still a greater impact upon the demand for domestic agricultural production and income to the agricultural sector because of the weakening preference for food. On the basis of earlier estimates for the high income consumers, the coefficients of the model are $\psi = 1.05$, $\Gamma = 1.013$, $e = -0.5$, and $\varepsilon = 0.40$. With these coefficients, prices decline by 3.9 percent and quantity demanded increases by 3.3 percent, resulting in a 1.7 percent decline in domestic production and a revenue loss of 5.53 percent for agricultural producers.

Work projects which utilize food aid as wages-in-kind

Wages-in-kind payments have essentially the same impact on consumption patterns and domestic production that grants do, with one major exception. With wages-in-kind, the labor input for which commodities are exchanged produces an additional shift in supply depending on the productivity of labor and the nature of the projects. The three broad classes of projects include direct production, short-run overhead, and long-run overhead. The impact on productivity is also a function of the allocation of work projects between sectors of the economy.

To analyze the impact of food aid used as wages-in-kind on work projects under alternative assumptions about productivity, several different allocations of investments and rates of return are considered. Annual increases in supply resulting from the work projects are considered at 2, 5, and 10 percent. With a 2 percent supply increase, a 5 percent food aid contract, and recipients in the $75 income class, the variables for

the equilibrium model are $\psi = 1.07$, $\Gamma = 1.0275$,[1] $e = -0.90$, and $\varepsilon = 0.40$. The impact of food aid used in this manner drives prices down by about 3.08 percent and increases total quantity of food demanded by 5.7 percent. Since 5.0 percent of the increase is supplied from food aid, only 0.7 percent comes from domestic production, resulting in a decrease in income for agricultural producers of about 1.0 percent. If the supply increase experienced from the work projects drawing labor from the group with annual per capita income around $75 is 5 percent instead of 2 percent, the impact is even greater. Prices are driven down by approximately 5.1 percent and the net effect on domestic supply is an increase of 2.7 percent; income to domestic producers falls by about 2.5 percent. Likewise, if the supply response of the same class of work projects if 10 percent, the resulting price decline is about 8.3 percent. With a net domestic supply increase of 6.1 percent, the resulting income loss for domestic producers is about 2.7 percent.

Consistent with theoretical supply and demand relationships, the allocation of only half of the work projects to the agricultural sector would have less negative impact on income to agricultural producers than allocation of all the projects to agriculture. The smaller the work project force in agriculture, the smaller the impact on domestic supply, and consequently the smaller the impact on agricultural prices and income.

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[1] Although the shift in production is greater than in the grant case, the increase in domestic production does not result in an increase in consumer income as does the food aid. Therefore, values for Γ will be the same as before.

Open-market sales to augment domestic supply

Distributing food aid through open-market sales at competitive market price affects the supply side of the food market exclusively. For analysis of the open-market system, three income groups will be considered in combination with two levels of reinvestment in agriculture and three levels of return on projects. For this analysis it will be assumed that the government does not relieve taxes and consequently does not provide any direct income effect on consumers. On this basis a food aid contract amounting to 5 percent of present supply combined with reinvestment in projects using labor from the $75 class and resulting in a 2 percent shift in supply would cause a 4.8 percent decline in prices and a corresponding 0.2 percent decline in domestic supply. The resultant loss of income for the agricultural producers would be about 5 percent.

Comparatively, financing projects in the same way, but drawing labor from the $250 class, would increase the price decline to 6.0 percent and the supply reduction to 0.6 percent for about a 6.5 percent income loss for agricultural producers. Use of labor from the $450 class would cause an even greater decline of about 7.2 percent for prices and 1.2 percent for supply so that income would fall by 8.4 percent.

Use of the open market system of distribution is not adequate to achieve a positive sum gain for producers and consumers at the same time unless the price elasticity of demand is greater than unity. Positive sum gains could be achieved through the sale of food aid commodities if the marketing procedure results in a demand expansion. The amount of shift in demand necessary to simultaneously depress prices for consumer

benefit and maintain gross revenue for producers, assuming that revenue from sale of P.L. 480 commodities can be transferred to producers, depends on the relative size of supply and demand elasticities and the proportion of total supply which the food aid represents.

Revenue before the imports (R_1) is equal to P_1 times Q_1. Revenue after importing and selling P.L. 480 commodities (R_2) is equal to P_2 times Q_2. From Equations D.6 and D.8, the change in revenue

$$R_2 - R_1 = (\Gamma^{\xi} \psi^{-\xi}) P_1 (\Gamma^{\xi\varepsilon} \psi^{1-\xi\varepsilon}) Q_1 - Q_1 P_1 \qquad D.10$$

is zero if $\Gamma^{\xi(1+\varepsilon)} \psi^{1-\xi(1+\varepsilon)}$ is equal to 1.0. Therefore, revenue will be unchanged if

$$\Gamma = \psi^{-(1+e)/(1+\varepsilon)} \qquad D.11$$

For the low income case where $e = -0.9$ and $\varepsilon = 0.4$, P.L. 480 imports equal to 5 percent of domestic supply would require a shift in demand of 0.35 percent or about one-third of 1 percent to maintain producer revenue. For the medium income case where $e = -0.7$ and $\varepsilon = 0.4$, a 5 percent increase in supply through sale of P.L. 480 commodities would require a shift in demand of 1.04 percent to maintain revenue from food purchases. For the high income case with $e = -0.5$ and $\varepsilon = 0.4$, demand would need to shift to the right by 1.72 percent to maintain constant revenue from food sales.

REFERENCES

1. Abel, Martin E. and Cochrane, Willard W. Expanding the demand for farm food products: programs and results. Minnesota Agricultural Experiment Station Technical Bulletin 238. April 1961.

2. Abel, Martin E. and Rojko, A. S. World Food situation. U.S. Department of Agriculture, Foreign Agricultural Economics Report 35. September 1967.

3. Adams, Dale, et al. Public Law 480 and Colombia's economic development. Medillin, Colombia, Department of Agricultural Economics, Michigan State University and Departments de Enconomia Y Ciencias Socioles, Facultad de Agronomia E. Instituto Forestall Universidad Nacional de Colombia. 1964.

4. Aktan, Resat. Analysis and assessment of the economic effects, Public Law 480 Title I program, Turkey. Turkey, University of Ankara. 1965.

5. Andersen, Per P. The role of food, feed, and fiber in foreign economic assistance: value, cost, and efficiency. Unpublished Ph.D. thesis. Stillwater, Oklahoma, Library, Oklahoma State University. 1959.

6. Bawa, Ujagar S. Agricultural production and industrial capital formation, India 1951-52 to 1964-65. Ithaca, New York, Department of Agricultural Economics, Cornell University, Occasional Paper 25. October 1969.

7. Behrman, J. R. Supply response in underdeveloped agriculture. Amsterdam, North-Holland Publishing Company. 1968.

8. Benedict, Murray R. and Bauer, Elizabeth K. Farm surpluses: U.S. burden or world asset? Berkeley, University of California. 1960.

9. Beringer, Christoph. Real effects of foreign surplus disposal in underdeveloped economies: comment. Quarterly Journal of Economics 77(2): 317-323. May 1963.

10. Beringer, Christoph and Ahmad, Irshad. The use of agricultural surplus commodities for economic development in Pakistan. Karachi, Institute of Development Economics. January 1964.

11. Blakeslee, Leroy L. An analysis of projected world food production and demand in 1970, 1985, and 2000. Unpublished Ph.D. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1967.

12. Blau, Gerda. Disposal of agricultural surpluses. Rome, Food and Agriculture Organization, Commodity Policy Study 5. June 1954.

13. Brandow, George E. Interrelations among demands for farm products and implications for control of market supply. Pennsylvania Agricultural Experiment Station Bulletin 680. August 1961.

14. Brazzel, John M. Leakage reducing employment and income multipliers in labor-surplus rural areas: comment. Journal of Farm Economics 49(4): 920-922. November 1967.

15. Brown, Lester P. Man, land and food. U.S. Department of Agriculture Foreign Agricultural Economic Report 11. November 1963.

16. Burk, Marguerite C. Trends and patterns in U.S. food consumption. U.S. Department of Agriculture Handbook 214. June 1961.

17. Center for Agricultural and Economic Development. World food balances, international trade, and implications for U.S. food aid. Unpublished mimeographed interim report submitted to the Agency for International Development. Ames, Iowa, author. June 1969.

18. Clark, Colin. World supply and requirements of farm products. Journal of the Royal Statistics Society 117(3): 263-291. 1954.

19. Coale, Ansely J. and Hoover, Edgar M. Population growth and economic development in low-income countries. Princeton, New Jersey, Princeton University Press. 1958.

20. Cochrane, Willard W. Farm technology, foreign surplus disposal and domestic supply control. Journal of Farm Economics 41(5): 885-899. December 1959.

21. Congressional Quarterly Service. U.S. agricultural policy in postwar years: 1945-1963. Washington, D.C., author. 1963.

22. Cummings, Ralph W., Jr. and Ray, S.K. 1968-69 foodgrain production: relative contribution of weather and new technology. Economic and Political Weekly 1969: A163-A174. September 27, 1969.

23. Davis, John H. Surplus disposal as a tool for world development--objectives and accomplishments. Journal of Farm Economics 40(5): 1484-1494. December 1958.

24. Desai, D. K. Increasing income and production in Indian farming. Bombay, India, Indian Society of Agricultural Economics. 1963.

25. Directorate of Economics and Statistics. Bulletin on food statistics. New Delhi, India, Ministry of Food, Agriculture, Community Development and Cooperation. 1970.

26. Egbert, Alvin Charles. Programming regional adjustments in resource use for grain production. Unpublished Ph.D. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1958.

27. Ezekiel, Mordecai. The international perspective. Journal of Farm Economics 42(5): 1063-1077. December 1960.

28. Falcon, Walter P. Farmer response to price in an underdeveloped area--a case study of West Pakistan. Unpublished Ph.D. thesis. Cambridge, Massachusetts, Library, Harvard University. 1962.

29. Falcon, Walter P. Farmer response to price in a subsistence economy: the case of West Pakistan. American Economic Review (Papers and Proceedings) 54(3): 580-591. May 1964.

30. Ferguson, C. E. Microeconomic theory. Homewood, Illinois, Richard D. Irwin. 1966.

31. Fisher, Franklin M. A theoretical analysis of the impact of food surplus disposal on agricultural production in recipient countries. Journal of Farm Economics 45(4): 863-875. November 1963.

32. Food and Agriculture Organization. Agricultural commodities--projection for 1975 and 1985. Rome, author. 1967.

33. Food and Agriculture Organization. Nutrition and working efficiency. Rome, author. Freedom from Hunger Campaign Basic Study 5. 1962.

34. Food and Agriculture Organization. Uses of agricultural surpluses to finance economic development in underdeveloped countries. Rome, F.A.O. Commodity Policy Study No. 6. June 1955.

35. Food and Agriculture Organization, ECAFE. A note on the utilization of agricultural surpluses for economic development in Japan. Bangkok, author. 1958.

36. Food and Agriculture Organization, ECAFE. A note on the utilization of agricultural surpluses for economic development in Pakistan. Bangkok, author. 1961.

37. Framingham, Charles F. An international analysis of projected cereal grain production, requirements and trade and its implications for importing nations, major exporters and the fertilizer industry in 1975, 1985 and 2000. Unpublished Ph.D. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1969.

38. Ginor, Fanny. Uses of agricultural surpluses, analysis and assessment of the economic effects of the U.S. Public Law 480 Title I program in Israel. Jerusalem, Bank of Israel. 1963.

39. Goering, Theodore J. Public Law 480 in Colombia. Journal of Farm Economics 44(4): 992-1004. November 1962.

40. Goering, Theodore J. and Witt, Lawrence. United States agricultural surpluses in Columbia, a review of Public Law 480. Michigan State University Technical Bulletin 289. 1963.

41. Goreux, L. M. Income and food consumption. Food and Agriculture Organization Monthly Bulletin 9(10): 1-13. October 1960.

42. Heady, Earl O. Agricultural policy under economic development. Ames, Iowa, Iowa State University Press. 1962.

43. Heady, Earl O. Research and economic development, needs, opportunities, and problems. In Iowa State University Center for Agriculture and Economic Adjustment. Food, One Tool in International Economic Development. Pp. 1-31. Ames, Iowa, Iowa State University Press. c1962.

44. Hendrix, E. Priorities and programming. Mimeographed paper. Washington, D.C., Agency for International Development. 1969.

45. Hillman, Jimmye S. Agricultural surplus disposal, a case study, Brazil. Proceedings of the Western Farm Economics Association 31: 66-80. 1958.

46. Hoover, Dale M. and Maddox, James G. Food for the hungry: direct distribution and food stamp programs for low-income families. Washington, D.C., The National Planning Association. February 1969.

47. Houthakker, Hendrik S. An international comparison of household expenditure patterns, commemorating the centenary of Engel's law. Econometrica 25(4): 532-551. October 1957.

48. Humphrey, Hubert H. Food and fiber as a force for freedom. Report to Committee on Agriculture and Forestry, Committee Print, 85th Congress, 2nd Session. 1958.

49. India, Government of. Economic survey 1969-70. New Delhi, India. 1970.

50. India, Government of. National Council of Applied Economic Research. All India consumer expenditure survey. New Delhi, author. June 1967.

51. India, Government of. National Council of Applied Economic Research. Long-term projections of demand for supply of selected agricultural commodities, 1960-61 to 1975-76. New Delhi, India, author. 1962.

52. International Monetary Fund. International financial statistics 23(6). June 1970.

53. Johnston, Bruce F. and Mellor, John W. Agriculture's contribution to economic development. Stanford University Food Research Institute Studies I(3): 335-356. November 1960.

54. Johnston, Bruce F. and Mellor, John W. The role of agriculture in economic development. American Economic Review 51(4): 566-593. September 1961.

55. Johnston, J. Econometric methods. New York, McGraw-Hill Book Company. c1963.

56. Kahn, Alfred A. Agricultural aid and economic development, the case of Israel. Quarterly Journal of Economics 76(4): 568-591. November 1962.

57. Khatkhate, Deena R. Some notes on the real effects of foreign surplus disposal in underdeveloped economies. Quarterly Journal of Economics 76(2): 186-196. May 1962.

58. Krishna, Raj. Farm supply responses in India-Pakistan, a case study of the Punjab Region. Economic Journal 73(291): 477-487. September 1963.

59. Kuznets, Simon. Quantitative aspects of the economic growth of nations: the share and structure and consumption. Economic Development and Cultural Change 19(2): Part 2: 1-91. January 1962.

60. Lachman, Alexis E. The local currency proceeds of foreign aid. Paris, Development Centre of the Organization for Economic Cooperation and Development. 1968.

61. Lewis, W. Arthur. Economic development with unlimited supplies of labour. In A. N. Agarwala and S. P. Singh, editors. The Economics of Underdevelopment. Pp. 400-449. New York, Oxford University Press. 1958.

62. Manderscheid, Lester V. Some observations on interpreting measured demand elasticities. Journal of Farm Economics 46(1): 128-136. February 1964.

63. Mann, Jitendar S. The impact of Public Law 480 imports on prices and domestic supply of cereals in India. Journal of Farm Economics 49(1): 131-146. February 1967.

64. Mellor, John W. The economics of agricultural development. Ithaca, New York, Cornell University Press. 1966.

65. Menzie, Elmer L., Witt, Lawrence W., Eicher, Carl K., and Hillman, Jimmye S. Policy for United States agricultural export surplus disposal. Arizona Agricultural Experiment Station Technical Bulletin 150. 1962.

66. Ohkawa, Kazushi. Economic growth and agriculture. Hitotsubashi Academy 7(1): 46-60. October, 1956.

67. Pak, Ki Hyuk and Han, Kee Chun. An analysis of food consumption in the Republic of Korea. Seoul, Korea, Yonsei University. 1969.

68. Rath, Nilakanth and Patvardhan, V. S. Impact of assistance under P.L. 480 on Indian economy. Poona, India. Gokhale Institute of Politics and Economics. 1967.

69. Report of Federal Surplus Relief Corporation. Washington, D.C., U.S. Government Printing Office. 1935.

70. Rosenstein-Rodan, P. N. The consortia technique. International Organization 22(1): 223-230. 1968.

71. Schultz, Theodore W. Value of United States farm surpluses to underdeveloped countries. Journal of Farm Economics 42(5): 1010-1030. December 1960.

72. Sen, S. R. Impact and implications of foreign surplus disposal on underdeveloped economies, the Indian perspective. Journal of Farm Economics 42(5): 1031-1042. December 1960.

73. Srivastava, Uma Kant. Impact of P.L. 480 on Indian economy. Unpublished Ph.D. thesis. Lucknow, India, Department of Economics, Lucknow University. 1968.

74. Stevens, Robert D. Elasticity of food consumption associated with changes in income in developing countries. U.S. Department of Agriculture, Foreign Agricultural Economics Report 23. March 1965.

75. Toma, Peter A. The politics of food for peace. Tucson, Arizona, University of Arizona Press. 1967.

76. Umstott, Haven D. Public Law 480 and other economic assistance to United Arab Republic (Egypt). U.S. Department of Agriculture, Economic Research Service ERS-Foreign 83. June 1964.

77. United Nations. Yearbook of national account statistics 1968. Volume I--Individual Country Data. New York, Statistics Office of the United Nations. 1969.

78. United Nations. Yearbook of national account statistics 1968. Volume II--International Tables. New York, Statistics Office of the United Nations. 1969.

79. United States Agricultural and Conservation Service. Farm commodity and related programs. U.S. Department of Agriculture Agricultural Handbook 345. 1967.

80. United States Congress. Food for peace. House Document 104-91/1. April 1969.

81. Unites States Department of Agriculture. Feed statistics, supplement for 1969. U.S. Department of Agriculture Statistical Bulletin 410. November 1969.

82. United States Department of Agriculture. Grain and feed statistics through 1961. U.S. Department of Agriculture Statistical Bulletin 159. Revised, June 1962.

83. United States Department of Agriculture. Grain and feed statistics, supplement for 1964. U.S. Department of Agriculture Statistical Bulletin 159. March 1965.

84. United States Department of Agriculture. Orderly liquidation of stocks of agricultural commodities. Washington, D.C., U.S. Department of Agriculture. December 1968.

85. United States Department of Agriculture. Rice situation. U.S. Department of Agriculture Statistical Bulletin RS-14. October 1969.

86. United States Department of Agriculture. Statistics on cotton and related data, 1925-1962. U.S. Department of Agriculture Supplement to Statistics Bulletin 329. April 1963.

87. United States Department of Agriculture. Supplement for 1966 to Statistics on cotton and related data, 1925-1962. U.S. Department of Agriculture Supplement to Statistics Bulletin 329. November 1964.

88. United States Department of Agriculture. Wheat situation. U.S. Department of Agriculture Statistics Bulletin WS-212. November 1969.

89. United States Economic Research Service, Economics and Statistical Division. Cotton situation. U.S. Department of Agriculture Statistical Bulletin CS-240. August 1969.

90. United States Economic Research Service, Foreign Regional Analysis Division. The world food budget 1970. U.S. Department of Agriculture Foreign Agricultural Economics Report 19. 1964.

91. United States. Office of the Agricultural Attache. Brief on Indian Agriculture 1969. Mimeograph. New Delhi, India, American Embassy. 1969.

92. United States. Office of the Agricultural Attache. Brief on Indian agriculture 1970. Mimeograph. New Delhi, India, American Mebassy. 1970.

93. United States Statutes at Large 48, Chapter 25. 1934.

94. United States Statutes at Large 48, Chapter 90. 1934.

95. United States Statutes at Large 48, Chapter 103. 1934.

96. United States Statutes at Large 60, Chapter 281. 1946.

97. United States Statutes at Large 62, Chapter 169. 1948.

98. United States Statutes at Large 62, Chapter 704. 1948.

99. United States Statutes at Large 63, Chapter 175. 1949.

100. United States Statutes at Large 63, Chapter 792. 1949.

101. United States Statutes at Large 65, Chapter 479. 1951.

102. United States Statutes at Large 67, Chapter 195. 1953.

103. United States Statutes at Large 68, Chapter 469. 1954.

104. United States Statutes at Large 68, Chapter 1041. 1954.

105. United States Statutes at Large 78, P.L. 525. 1964.

106. United States Statutes at Large 80, P.L. 808. 1966.

107. United States Statutes at Large 82, P.L. 436. 1968.

108. United States Statutes at Large 82, P.L. 552. 1968.

109. Viner, Jacob. The economics of development. In A. N. Agarwala and S. P. Singh, editors. The Economics of Underdevelopment. Pp. 9-31. New York, Oxford University Press. 1958.

110. Waugh, Frederick V., Burtis, Edgar L., and Wolf, A. F. The controlled distribution of a crop among independent markets. Quarterly Journal of Economics 51: 1-41. November 1936.

111. Westmore, John M., Abel, Martin E., Learn, Elmer W. and Cochrane, Willard W. Expanding the demand for farm food products: history and potentials. Minnesota Agricultural Experiment Station Technical Bulletin 231. April 1959.

112. Witt, Lawrence. A program of research on Food for Peace, part II, the research map. East Lansing, Economic and Agricultural Development Institute, Michigan State University. January 1966.

113. Witt, Lawrence and Eicher, Carl K. The effects of United States agricultural surplus disposal programs on recipient countries. Michigan State University Research Bulletin 2. 1964.

114. Wold, Herman and Jureen, Larse. Demand analysis. New York, John Wiley and Sons. 1953.